JAN 26 1910

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second-class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the Act of Congress March 3, 1879

VOL. XXIV NO. 4 | SAN FRANCISCO, JANUARY 22, 1910 | PER COPY, 10 CENTS

Henshaw, Bulkley & Co.

ENGINEERS

Machinery Merchants

San Francisco: 19 - 21 Fremont Street
Los Angeles: 262 So. Los Angeles St.
Oakland: 1436 Fifth St.

OKONITE WIRE

OKONITE
TRADE MARK
REG. U.S PATENT OFFICE.

THE STANDARD for RUBBER INSULATION

Okonite Tape, Manson Tape,
Candee Weatherproof Wire,
Candee (Patented) Potheads.

The Okonite Company
253 BROADWAY, NEW YORK

WILLARD L. CANDEE, PRESIDENT — GEO. T. MANSON, GEN'L SUPT.
H. DURANT CHEEVER, TREASURER — WM. H. HODGINS, SECRETARY

PARANITE

INDIANA RUBBER AND INSULATED WIRE CO.

Manufacturers of Paranite and Peerless Rubber Covered Wires and Cables
Underground Aerial, Submarine and Inside Use
Telephone, Telegraph and Fire Alarm Cables
All Wires are Tested at Factory JONESBORO, IND.

Electric Appliance Company

728 Mission St., San Francisco — Pacific Coast Agents

Standard Underground Cable Co.

MANUFACTURERS OF
COPPER WIRES, CABLES AND ACCESSORIES
FOR ALL SERVICES

PACIFIC COAST DEPT. First National Bank Building, San Francisco
Sub-Office—Los Angeles, Cal.
GENERAL OFFICES: PITTSBURG, PA.
Factories Oakland, Cal., Pittsburg, Pa., Perth Amboy, N. J.
Branch Offices: New York, Boston, Chicago, Philadelphia, St. Louis

Phillips Insulated Wire Co.

PAWTUCKET, R. I.

"O.K." WEATHERPROOF
"PARAC" RUBBER COVERED

COMPLETE STOCKS CARRIED BY
OUR PACIFIC COAST AGENTS

California Electric Co. LOS ANGELES — Electric Appliance Co. SAN FRANCISCO — Western Electric Co. SEATTLE

Specify....

BROOKFIELD GLASS INSULATORS

The Standard

PACIFIC METER CO.

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

301 SANTA MARINA BUILDING
California and Drumm Sts. — San Francisco

VULCAN ..... Refrigerating and Ice Making Machinery

MANUFACTURED BY

VULCAN IRON WORKS

Office: 702 Atlas Bldg., 604 Mission St.
Works: Francisco and Kearny Streets — San Francisco

FOR INDEX TO ADVERTISEMENTS SEE PAGE EIGHT

A Motor for Real POWER ECONOMY

You wouldn't hire six men to do the work that two could do with ease. Yet perhaps you continue to use six horse power to drive a distant machine, by old line-shaft methods, that only requires about two horse power when driven by one of our adjustable speed motors. 623

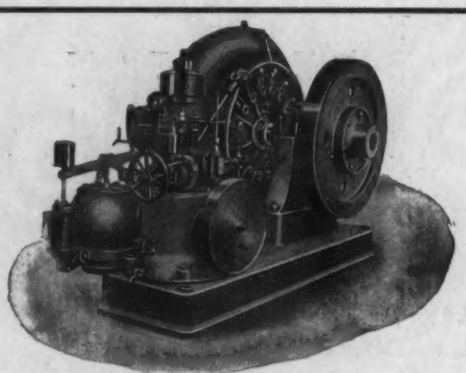
FORT WAYNE

MOTOR DRIVES

eliminate friction losses -- provide wide speed adjustments -- allow you to locate machines where work is -- increase the output and cut in half the cost of operation.

We have a bulletin 1415 on this subject that contains a lot of mighty valuable information and we want to send one to you. Write for it now.

Ft. Wayne Electric Works
Ft. Wayne, Ind.



PELTON-FRANCIS TURBINE AND GOVERNOR

Francis Turbine Water Wheels
of any capacity contracted for and installed
Write for Catalog and List of Operating Plants
THE PELTON WATER WHEEL CO.
1011 MONADNOCK BLDG., SAN FRANCISCO, CAL.
84 WEST ST., NEW YORK CITY

BRYAN-MARSH TUNGSTENS
HAVE BEEN
REDUCED IN PRICE
ALL SIZES IN STOCK
California Incandescent Lamp Co.
Six Sixty-nine Mission St.
SAN FRANCISCO

JANDUS
LUXOLABRA
ARE GOOD FOR THE CENTRAL STATION AS WELL AS THE PUBLIC IN GENERAL
Get our proposition and Catalog No. 36
Standard Electrical Works
Six Sixty-nine Mission St.
SAN FRANCISCO

FOR ECONOMY AND DURABILITY BETTER INVESTIGATE
THE GRANT
Lighting Specialties

Grant Flaming Arc Lamp
The simplest and most reliable of all 4,000 candle power. 550 watts.
Grant Miniature Arc Lamp
For interior illumination. A.C. or D.C.
Grant Tungsten Lamps
Burn in any position. Stand rough handling. 60 to 150 volts; also 220 to 250 volts. All standard sizes.

Parrott & Co.
320 California St., San Francisco
Telephone Douglas 2400
PORTLAND, ORE., Portland Trust Co. Bldg. TACOMA, WASH., Bank of California Bldg.
SEATTLE, WASH., Globe Block. SPOKANE, WASH., 161 S. Post St.
LOS ANGELES, Citizens' National Bank
HONOLULU, T. H., J. A. Gilman, Agt. GUATEMALA, C. A., J. Soto Rios, Agt.

©

CALB200360

JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXIV SAN FRANCISCO, JANUARY 22, 1910 NUMBER 4

[Copyright, 1910, by Technical Publishing Company]

ELECTRICAL EQUIPMENT OF COLUMBIA THEATRE

BY W. W. HANSCOM.

The electrical installation in the recently completed Columbia Theater of San Francisco is somewhat of an innovation in theater lighting in that city, for with the exception of the center dome and proscenium a combination extremely pleasing and dignified. As it is possible for only an artist to do justice to the architectural and decorative features of the theater these will not be included in this article.

Auditorium of Columbia Theatre Showing Electric Sunburst

box fixtures all of the auditorium lighting is by means of incandescent lamps concealed in the coves. The decorative scheme is also novel, gray, gold, old rose and blue being the predominating colors, resulting in

The electrical installation is of the highest character throughout, all wiring being installed in conduit and every possible requirement of service provided. Service is taken from both the City Electric Company

and the San Francisco Gas & Electric Company, the former supplying both direct and alternating current and the latter direct current only.

Both services enter the building at the curb in the service board room in the basement, the City Electric Company having installed an independent transformer for the a. c. in a special pit under the sidewalk. From the underground conduits the services are led to the transfer and meter board. After leaving the meters they are connected through triple pole, double throw switches to the main distributing board alongside. The blades of the triple pole switches are connected through Westinghouse triple-pole oil-break switches, mounted on the back of the distributing board, to the distributing bus bars. The oil-break switches are connected to levers in the ticket office on the first floor above so that it is possible in case of emergency to entirely disconnect the building from the street service without delay.

On the distributing board are two sets of bus bars, one for a. c. to supply the entire incandescent lighting, the other for d. c. to supply the motor and arc-light circuits.

All of the lighting in the front of the building is controlled from two panelboards in the ticket office, both of which are connected to the distributing board through separate feeders. To one of these panels are brought all of the circuits supplying the marquis, facade, lobby, office, ladies' dressing room and toilets; to the other all emergency and exit circuits.

By the arrangement of switches on the transfer and distributing boards it is possible to supply all of the light and power circuits from either company or divide them up between either in case of failure of part of the service.

In case of failure of the current supplying the emergency and exit lights panelboard, all of these circuits are automatically switched onto a storage battery located in the building, so that it is practically impossible to entirely deprive the auditorium of light.

Auditorium and stage lighting is controlled from a stage switchboard placed in a fireproof enclosure back and to the right of the proscenium arch in a position which gives the operator a good view of the stage. This board is fed from the distributing board by means of two sets of three-wire feeders, one for a. c. and the other for d. c.

The general arrangement of the stage board is clearly shown in the accompanying illustration. The panel switches on the top panels control all of the general lighting in the auditorium and are connected to three different master switches, controlling the lights in groups. With this arrangement any desired combination is easily effected and the lighting arranged for any class of performance.

The bottom section of the middle right-hand panel is devoted entirely to d. c. control and the balance of the board to a. c. or d. c., depending upon which service is being used. Both sections are fed through three-pole switches, the d. c., single and the a. c. double throw so that in case of failure of the a. c., a limited amount of current can be taken from the d. c. feeders. All the switchboards were made by the Drendell Electric & Manufacturing Company of San Francisco.

The principal lighting of the auditorium is by means of a sunburst in the center of the dome. This fixture, which is intended to represent the sun, contains three hundred 16 c. p., frosted lamps. Above the lamps are gilded, metal rays, the whole combining to make a fixture of exceptional beauty and brilliancy, bringing out to the best advantage the architectural and decorative features of the interior.

The proscenium arch, where it would be shadowed by the light from the sunburst, is illuminated by a row of incandescent lamps concealed in the cove underneath. To further equalize the illumination of the gallery, balcony and orchestra, cove lighting is installed in the cornice at the rear of the gallery, at the rear and middle of the balcony and at the rear of the orchestra. This arrangement makes it possible to read the finest print with ease and at the same time entirely conceal the source of light from the eye when in a normal direction. One circuit from each group of cove lights is brought to a separate switch on the stage board so that it can be left in if desired when the house is darkened.

The proscenium boxes are lighted by specially designed fixtures, finished in gold and trimmed with multi-shaped crystal pendants, behind which are placed the incandescent bulbs. These fixtures are concealed to most of the audience by drapes suspended from the tops of the boxes.

The main foyer is lighted by three ceiling fixtures, the center supplied by five circuits and each of the others by two circuits. The balcony and gallery foyers are lighted by ceiling fixtures supplied from two circuits, one of which is the emergency and the other for general lighting, controlled by local push switches so that all but the emergency lights can be turned off during the performance.

The stairways and landings are lighted entirely by bracket fixtures, placed one at each landing and one midway of each flight of stairs. All of these lights are on the emergency circuits.

The facade is lighted by nine 250 watt tungsten lamps with Holophane reflectors concealed by specially designed hoods, located above the marquis and behind the front ornamentation. The marquise is lighted by 40 watt tungsten lamps spaced around the entire bottom edge and behind the glass decorative panels.

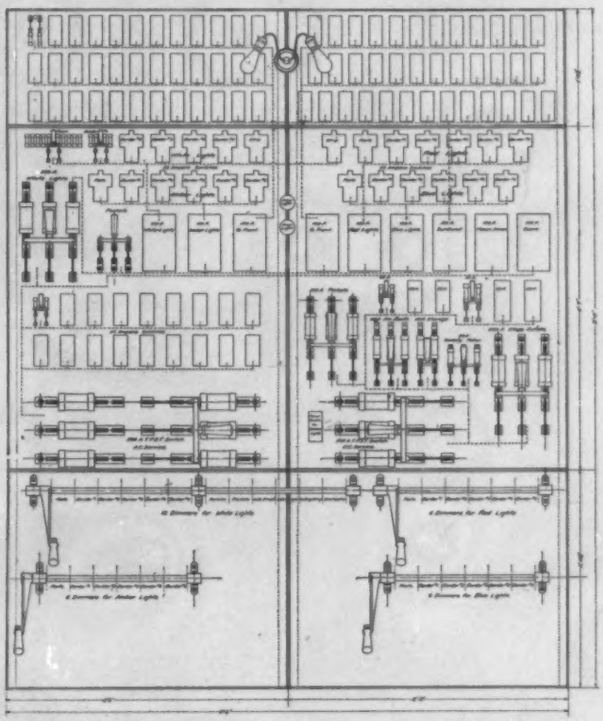
The stage lighting is laid out on the four-color scheme,—white, amber, red and blue. Each of the five borders have receptacles for 200 lights, 50 of each color. Each color is controlled by a separate switch on the board for each border, similar colors on all the borders and foots being controlled by a master switch. The foots extend the entire width of the arch and are fitted with 132 lights and controlled by individual and group color switches. The strip lights on either side of the arch are each fitted with 24 white lights only.

There are 39 pockets on the floor of the stage, 26 for incandescent and 13 for arc lighting, four on each side of the arch, above the stage, for arc lighting and one on the fly gallery for incandescent. All pocket circuits are fed from a fuse panel for each class, located to the rear and side of the main board and controlled by master switches on the stage board.

All lights in the dressing rooms, on the gridiron, fly gallery, property rooms, scene docks, under the

stage and auditorium in the attic and the carpenter shop are controlled from the stage board. Plug outlets are provided on each floor for a portable bunch light to be used in cleaning the auditorium. Orchestra lights are supplied from 40 plugs in the musicians' pit arranged in a row on the front of the stage about 18 inches above the floor.

The stage lights are under the control of a bank of "Simplicity" interlocking dimmers, made by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. The operating levers are mounted directly on the switchboard, within easy reach of the electrician, while the dimmer plates themselves are located beneath the stage, the connection to the levers being made by means of steel racks of suitable length. This arrangement leaves plenty of room behind the switchboard, an advantage too often lost sight of in theater installations. All of the parts above the stage floor are copper plated to conform to the general finish of the board.

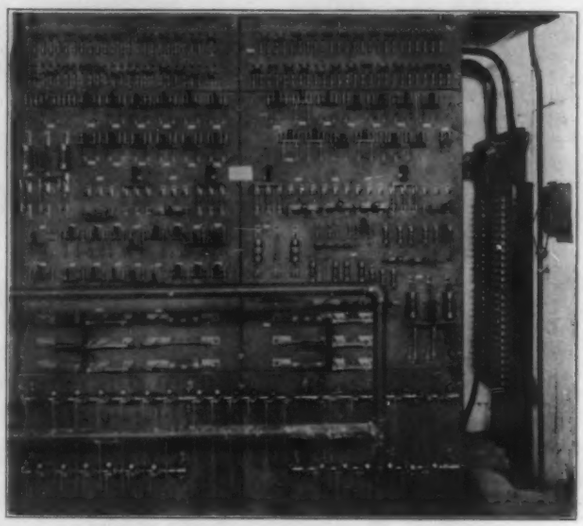


Switchboard Diagram.

The dimmers are arranged in four sections, one section controlling the white, one the red, one the blue, and the fourth the amber lights. The section for the whites contain 12 dimmers, while those for the other three colors contain six each, all dimmers being of approximately 50 lights capacity. Each dimmer has its own operating lever and the dimmers in each section are under the control of a separate master lever, by means of which any combination of lights in any section may be dimmed or brought up at will. They are mounted in two rows on an angle iron frame, located in a separate space where they are well ventilated and particularly accessible, and any one can be cleaned or overhauled without disturbing another. The dimmers control the lights as follows, each color on the borders and foots, each side strip, all of the incandescent pockets on either side of the stage, the pocket on the fly gallery for ceiling strip, and the orchestra lights. Master levers control the following groups, all white lights, all ambers, all reds and all blues. All white lights on the stage and in the auditorium are also controlled by one master switch.

In the power system there are five motors totaling 25 h. p., three of which are on the ventilating system, one on the pneumatic cleaning and one in the carpenter shop.

The storage battery consists of 60 Gould cells having a capacity of 80 amperes for one hour and installed in a ventilated compartment in the basement. They are charged from the 220 volt power circuit through a rheostat and combination over-and-under-load and no-voltage circuit-breaker which automatically opens the circuit upon the completion of the charge. A voltmeter and ammeter on the stage board indicates the charging current and terminal voltage of the cells. The circuit to the emergency lighting panel runs direct so that it cannot be opened or closed except by the automatic switch.



Main Switchboard, Columbia Theatre.

Two telephone systems are installed, one for the public service connecting the ticket and executive offices, ladies' dressing room, smoking room and balcony foyer through a local private exchange, and the other an intercommunicating Couch 10-station system connecting the working parts of the house with the manager's office. From the stage manager's position, call bells, speaking tubes and flash signals connect with the fly gallery, orchestra, musicians' room, smoking room, dressing rooms and under the stage.

For the present the building is heated by steam furnished at 100 lb. pressure from the power plant of the St. Francis Hotel, one block east.

Every possible contingency and demand that could be thought of has been provided, the result being an installation thoroughly up to date in every respect. The electrical work was installed by the Decker Electrical Company under the plans, specifications and instructions of the architects for the theater, Messrs. Bliss & Faville, who have to their credit one of the most complete, substantial and beautiful theaters in the United States.

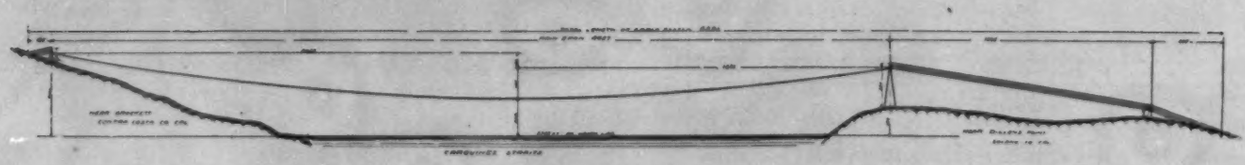
THE CARQUINEZ SPAN.[1]

The Straits of Carquinez is a comparatively narrow waterway separating Solano and Contra Costa counties, of California, and connecting San Pablo and Suisun Bays, which together form the northerly extremity of San Francisco Bay. At the point selected for the crossing the water is about 2750 feet wide with a depth ranging up to 120 feet, and through this narrow gap flow the waters of the Sacramento and San Joaquin Rivers as well as an ocean tide of about five feet, making at all times a heavy and dangerous current, which, though not so strong as to prevent the laying and operation of telegraph and telephone cables, is sufficiently so that it makes their maintenance a serious item and utterly precludes any possibility of laying and operating high tension power submarine cables. Of course the laying of such cables was considered very carefully, but the strength of the current in the channel together with the rocky character of its bottom and the impossibility of constructing heavy high tension cables that would operate at 60,000 volts and give assurance of withstanding the abrasion of the channel, soon led to the conviction that the only possibility of crossing the straits was to be found in the aerial method.

A survey of the conditions showed the waterway to be of the width and depth indicated, and that a bluff known as Dillon's Point existed on the north or Solano side of the straits, rising to a height of 162 feet above extreme high tide. On the south, or Eckley side, in Contra Costa county, exists a hill rising about 100 feet from the water's edge, whence it continues to rise in a general incline until, when perhaps half a mile back, an elevation of 400 feet has been reached. In front of this 100-foot bluff is the main line of the Southern Pacific railroad running from Port Costa to Oakland, along which, at Eckley, are numerous telegraph and telephone lines, a hotel, warehouse buildings and other houses constituting the settlement. Within a radius of a mile or so along the water front are the sugar refineries at Crockett, the smelters at Selby, and the enormous warehouses at Port Costa and vicinity which handle practically the entire grain output of the State for foreign shipment. Directly opposite, on the north side of the straits, where Dillon's Point is located, is found the southerly portion of Mare Island where the United States Navy Yard harbors the Pacific squadron. The Carquinez span reaches from the 400-foot elevation back of Eckley, across to Dillon's Point, passing directly over Eckley. The United States Government, in granting permission to cross at this point, stipulated that a clear headroom of at least 200 feet should be allowed for vessels.

To meet all requirements it was finally decided to erect a steel tower 225 feet in height at a suitable position on Dillon's Point, and another steel tower 64 feet high back of Eckley on the south side at the 400-foot elevation referred to. These two towers are known as the "main" and "south" towers respectively, and the horizontal distance between their perpendiculars is 4427 feet. It must be borne in mind, in endeavoring to understand the reasons which led to the adoption of the plan followed in erecting the span, that a minimum clearance of 200 feet had to be provided above the surface of the water; hence, in order to limit the height of the main tower to 225 feet, as was advisable, it was decided to so locate the south tower on the hillside that its top should be 80 feet higher than the top of the main tower, thus throwing the lowest point of sag in the span off the lineal center between the two towers; in fact, this lowest point is 2455 feet from the south tower and 1972 feet from the main tower, as shown in the drawing presenting the profile of the crossing. A further reason for the arrangement adopted is found in the fact that the land north of the main tower falls away to a marsh at near tide level,

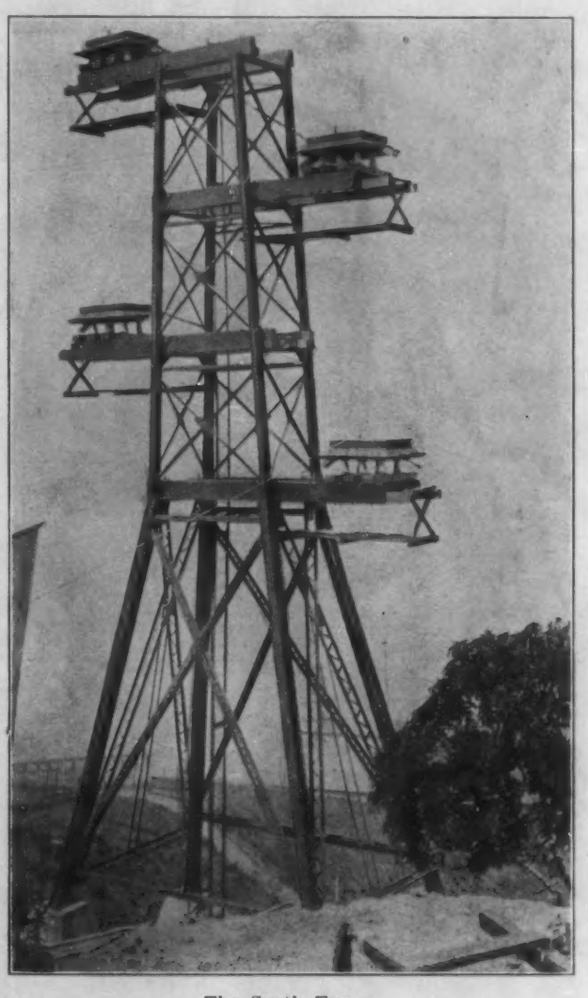
The 4427 ft. Span of the Pacific Gas & Electric Co. Across Carquinez Straits.



Profile of Span.

[1]Reprinted by request from the May and October, 1901, numbers of the Journal of Electricity, Power and Gas.

which made it necessary to turn the cables down to anchorages some 1700 feet back of the main tower. This condition compelled a great change in the dip of the cables between the main tower and the north anchorages, and necessitated the erection of the third or north tower, which, because of this change in direction of the cables, was built to lean toward the north. Its inclination is at an angle of 13 degrees from the perpendicular, and this has led to its being known as the "leaning" tower, although the company terms it the "north" tower.



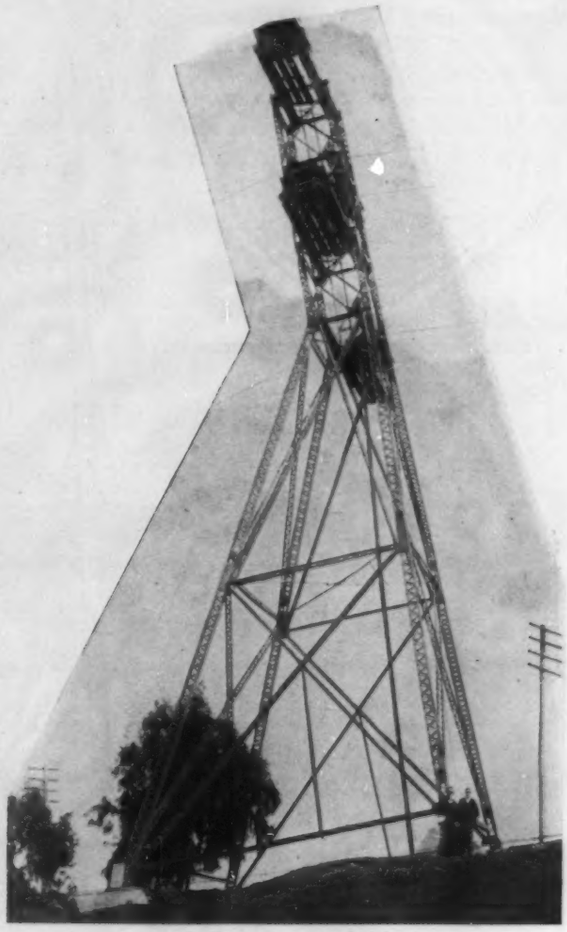
The South Tower.

The three towers are of steel and iron throughout with the exception of the main cross-arms supporting the cable saddles, which were of course designed to afford an insulating support for the cables. The principal interest in the strains and stresses to which these structures are subjected centers in the main tower, wherein compression and tension strains were thus determined: Assuming that the maximum pressure exerted by the wind will be 40 pounds per square inch, the maximum strains of compression upon each of the four corner posts of the main tower are:

Wind strains	76,500 lbs.
Live load	6,000 "
Dead load	50,010 "
Maximum compression strains	132,510 lbs.

On the other hand, the theoretical maximum tension strains amount in the aggregate to 9400 pounds, while the practical maximum allowed is 17,600 pounds, affording an ample factor of safety.

Twelve concrete piers with the corner ones arranged in a quadrangle measuring 69 feet by 89 feet between the pier centers, support the main tower, and these four main or corner piers are cubes of concrete having eight-foot sides. Bedrock is close to the surface on Dillon's Point, hence these piers are designed more to give weight as anchorages than to serve as foundations; or to express the idea in other words



The Leaning or North Tower.

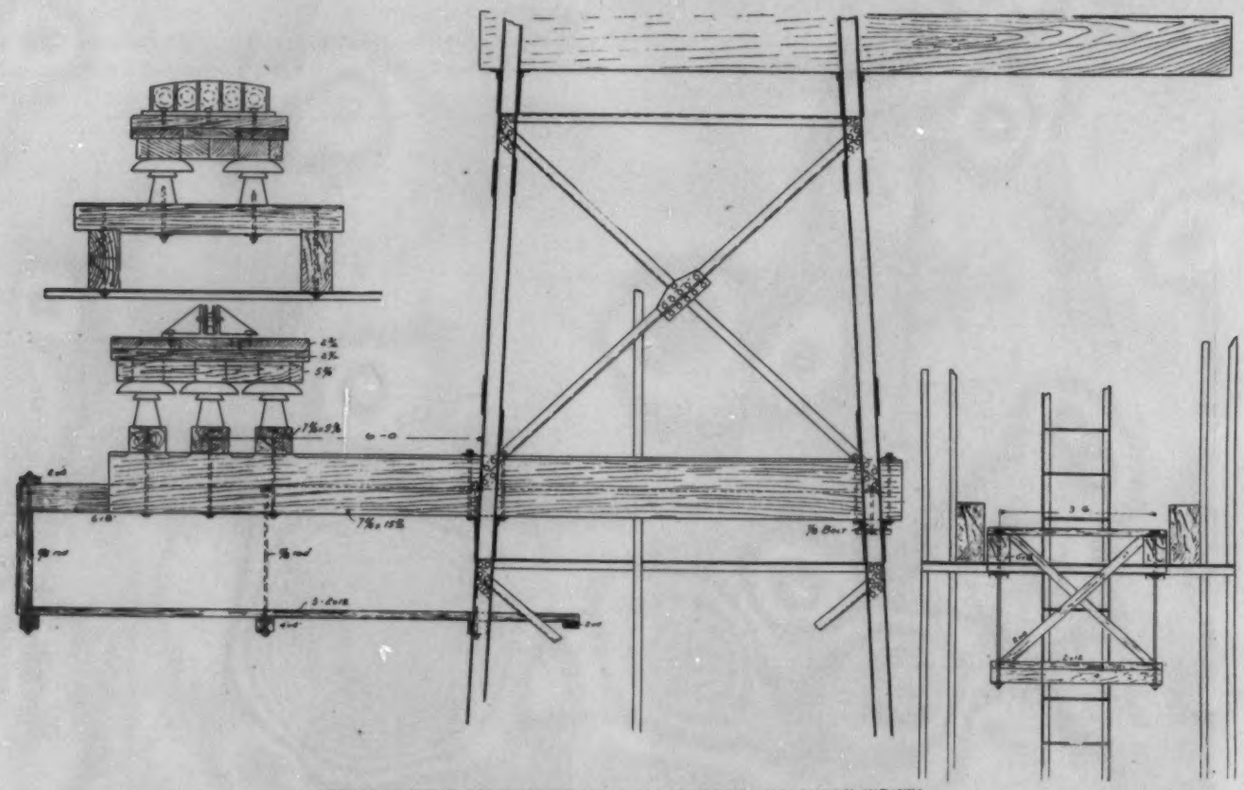
the concrete blocks are of greater utility for the weight they possess than for their serviceability as supports, although both are important. The two smaller towers are each supported on four piers, also of concrete, those of the south tower forming the corners of a quadrangle measuring 16x20 feet on the pier centers, while those of the leaning tower measure 31x28 feet on the pier centers.

If the structures are viewed from their electrical standpoints, the greatest interest will be attached to the means for supporting the cables from the towers and for insulating them from their anchorages—for it must be borne in mind that the cables carry 60,000 volts. Beyond this, when it is remembered that each cable exerts a pull of twelve tons on its anchorages, the fact will at once be appreciated that the problem

of securing adequate insulation, coupled with sufficient mechanical strength, was by no means one of easy solution. The headwork, or cable supporting methods of the three towers, are identical in design, dimensions and materials. The timbers are of Oregon pine thoroughly kiln-dried, puttied and then given two coats of oil, after which they are covered with two coats of the best spar varnish. Two main cross-arms, each 17 feet 8 inches long by 7¾ inches thick by 15¾ inches deep, support three 7¾x9¾x6-foot cross timbers upon each of which are mounted the two steel insulator pins that in turn carry the great porcelain Locke insulators that weigh approximately 50 pounds each, tested to 120,000 volts.

two courses each consisting of three 2¾-inch by 4-feet 6-inch planks. The whole upper platform is covered with the heaviest canvas and well painted with P & B paint, and wooden spouts, not shown in the drawing, are provided for carrying rainwater well away from the insulators.

The cable saddle is mounted directly upon this upper platform, being secured thereto by six bolts which do not go through the upper course of planking. These saddles are of galvanized cast-iron measuring 3 feet by 2 feet 2 inches, with an extreme height of 9 inches. A longitudinal channel 3 inches wide with walls each braced by six ⅝-inch ribs, is cast into the saddle base, and in this channel are placed five cast-iron

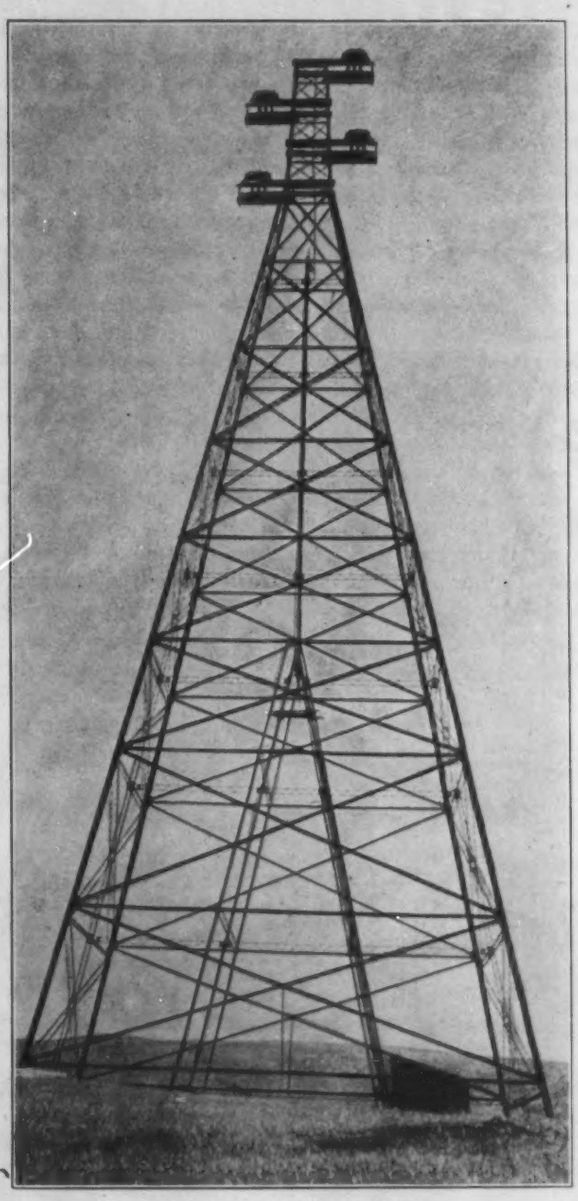


DETAILS OF THE TOWER CROSS TIMBERS, CABLE INSULATORS AND SADDLE SHEAVES

Reverting to the drawing, the steel pins referred to above are not shown therein, although the bolts which enter up into the steel pin appear as penetrating the six-foot cross timber and entering the insulators. These pins stand 14 11-16 inches high above their cross-arms, their cone has a base of 5⅜ inches in diameter, a height of 11 inches and a top of 2 inches in diameter, while the remaining 3 11/16 of the total height of the pin is cylindrical in shape, 2 inches in diameter, and cut with a standard thread to carry the great insulator. Steel bolts, 13 inches long by 1⅜ inches in diameter hold the pins to their cross-arms, the bolts being drawn up by nuts placed under 4½-inch washers and held by check-nuts. There are six insulators to each cable saddle, and the head of each insulator is countersunk into the timbers forming the upper platform—all these upper platform timbers, by the way, being boiled in paraffine. Above the countersunk timbers, which are two in number, each measuring 4 feet 2 inches by 1 foot 8 inches, are placed sheaves supported on 1 1/6-inch steel pinions the centers of which pinions are on an arc with an 8-foot radius. These sheaves have a diameter of 5⅞ inches by an extreme width of 3 inches, and they are galvanized—as in fact are all cast-iron pieces exposed to the weather.

An extreme variation in temperature of 60 deg. F. may possibly occur at Carquinez, which would cause a variation of 5 feet in the sag and which in turn would cause a travel of approximately two inches to occur in the cables running over the sheaves of the main tower.

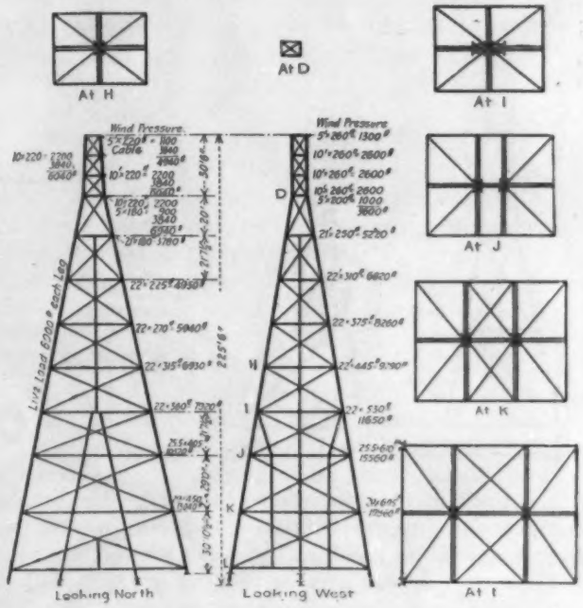
Individual anchorages, well separated, are provided for each cable, and they consist of masses of concrete, each having a base of 9 by 10 feet and being 5 feet high, set into the bedrock. Embedded in the concrete blocks are crossed channels and plates from which extend steel eyebolts with pin connections, first, to two sets of steel car springs, then a turnbuckle, then two tandem yokes connecting with heavy micanite insulators in copper cases containing trans-



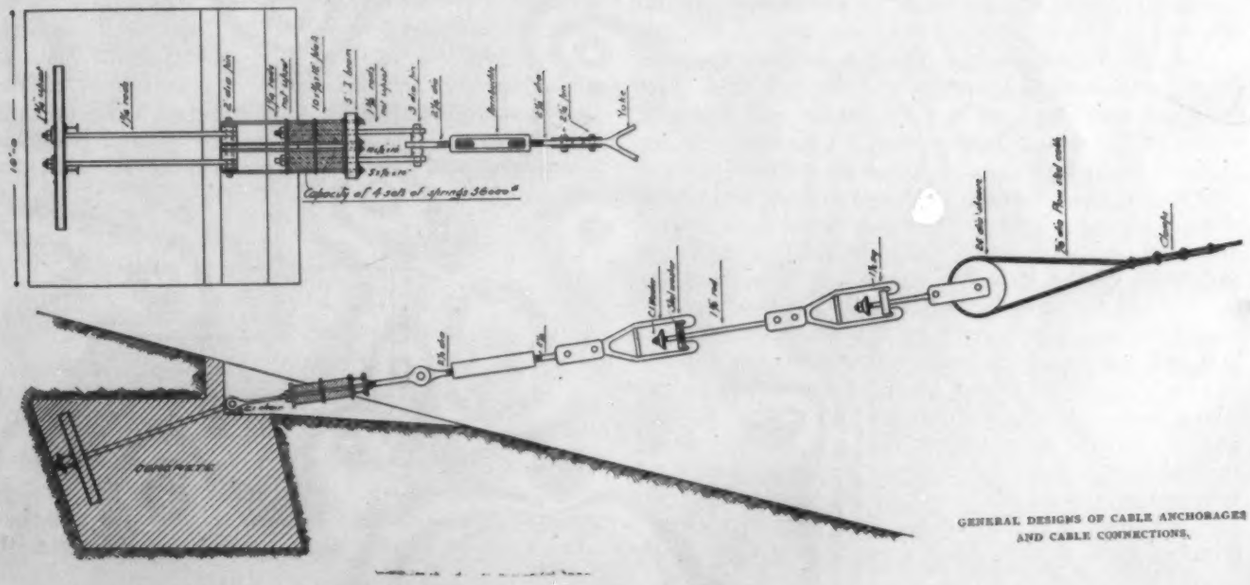
Front View of Main Tower.

former oil; and lastly, a 24-inch sheave around which the cable is turned and secured with clamps and clips.

The cables consist of nineteen single-strand wires, weigh one and six-tenths pounds per lineal foot, and have a total breaking strength of 96,000 pounds, the unit breaking stress of the material being about 200,000 pounds per square inch. The wires had three coats of oil. Supporting nothing, but themselves, each cable takes the form of a catenary, which has a half-span of 1972 feet, and a deflection of 147 feet, measured from the main tower,. and a half-span of 2455 feet and a deflection of 227 feet, measured from the south tower. On this basis each cable would have a tensile load at the main tower of 21,840 pounds, and at the south tower of 22,000 pounds. Experiments were made of the effect of the wind pressure, and the conclusion was reached that it might, in extreme cases, double the calculated strains, and the cables were considered amply



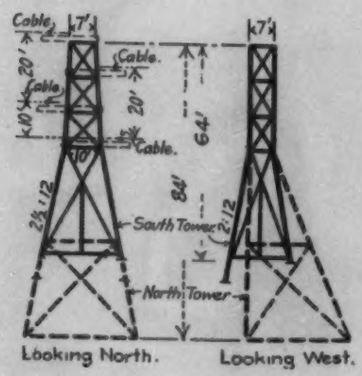
Stress Diagram of North Tower.

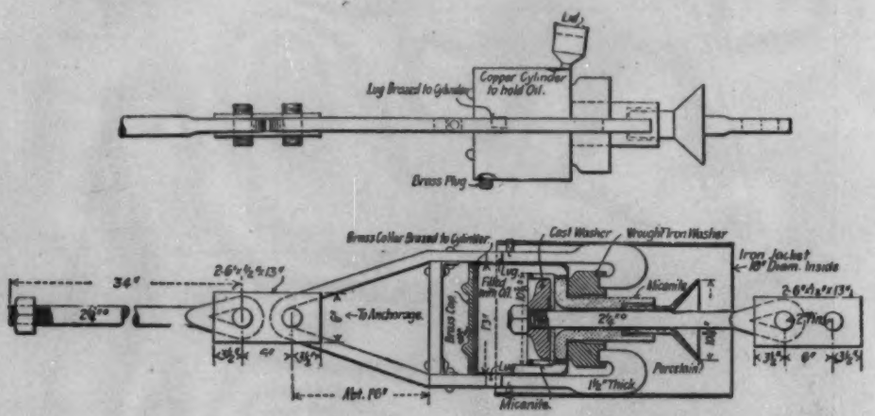


GENERAL DESIGNS OF CABLE ANCHORAGES AND CABLE CONNECTIONS.

safe for this. It has been found since that wind pressure will not strain the cables as much as assumed, as practically no shocks due to undulations will occur —simply a static pressure, due to a certain lateral deflection of the cables under heavy winds. It has been found that even in a gale the cables remain practically stationary at a certain lateral deflection, due to the wind, and that the wind does not produce undulations as had been expected.

The towers are of iron and steel throughout, except cross arms for carrying the cable saddles. The main tower is 225½ feet in extreme height from the foot of the lowest column, and has a base about 68x90 feet. The four main posts are each made of two 12-inch channels, battered in both directions, the center distances, of 9½x6½ feet at a point 30½ feet below the top, above which they batter in one direction only to a top width of 6½ feet both ways. The channels in the columns vary in size from 12-inch 30 pounds at the base (reinforced by one 5x3-inch angle in each lower section), where they sustain a maximum compression of 132,510 pounds in each column, to 5-inch

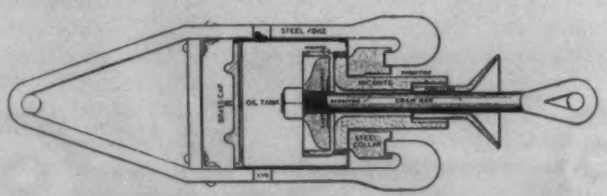




6¼ pounds at the top, where they have 5300 pounds compression in each column. The design was made to fit material on hand, as time was limited.

The pyramidal part of the tower is divided into stories from 20 feet high at the top to about 38 feet high at the bottom, braced with horizontal and diagonal struts in each face, as shown in the diagram. These struts are all made of four angles from 3x2 inches to 2x2 inches, pairs of them being latticed together with their flanges about 8 inches apart and their webs turned out from the center of the strut. Where these struts intersect, one of them is continuous and has a connection plate on each flange and the other one is cut to clear and riveted to each plate. These struts are connected to the columns by pairs of plates shop-riveted to the flanges and webs of the latter. On the opposite transverse faces of the tower and in a parallel vertical plane, midway between them, there is a pair of intermediate battered columns each composed of four 2x3-inch and 2x2-inch angles reaching to the fourth story, above which there is a single center column of four 2x2-inch angles reaching four stories higher. In each longitudinal face of the tower there is a similar center column seven stories high, and in all of them the two pairs of angles are latticed together with their flanges 8 inches apart, back to back, so as to pass through the horizontal and diagonal struts and be riveted to their flanges at intersections. The other vertical and inclined members in the lower stories of the tower are simply pairs of small suspension angles to support the centers of the long horizontal members. The main columns are spliced with flange and web plates just above the horizontal struts; all members were shipped separately and field riveted at intersections and connections. The main columns are anchored to crossed 4-inch I-beams in the bottom of the concrete blocks; the other columns are anchored with long bolts and washers built in the concrete. At every story the tower has ⅞-inch to 1⅛-inch horizontal lateral diagonal rods which are pin connected to angles riveted to the columns and to extensions of the tie plates on the horizontal struts. The members and connections of the bent tower are similar to those of the main tower, except that in the transverse face the struts are riveted to the column-web splice plates and elsewhere are riveted directly to the column channel webs without connection plates and that the lateral diagonals are single riveted angles. The columns are made of pairs of 8-inch channels, latticed, and the other members are each made of four 2x2-inch angles.

Micanite has been the salvation of the tandem strain insulators used to support the cables of the great Carquinez span, of the Bay Counties Power Company, for it combines great mechanical with dielectric strength. Unfortunately, however, micanite does not possess good surface insulation; that is to say, the shellac which is used to glue the layers of mica together oxidizes and offers a low creepage surface. This defect was overcome by combining with the micanite in this insulator the advantages of oil and porcelain, using the porcelain where mechanical strength was not required.



The detailed sectional drawing and photograph of the unassembled parts will best describe the arrangement of this insulator. The conical porcelain tube here shown gives ample surface insulation between the

drawbar and the steel collar corresponding to the difference of potential of the insulator, while the oil inside the copper tank acts in like service as well as to prevent arcing between opposite parts. The grooves shown on the flange of the micanite bushings are to increase the length of creepage surface, which, even in oil, is for this voltage not wholly to be relied on unless ample distance is given. The small cylinder or funnel on top of the tank is provided for filing it with oil and to inspect the oil level. While one of these strain insulators has sufficient insulation for the voltage used, it was deemed best to place two of them in series, so in case one gave out there would still remain a protection from grounding the cable.

It will, of course, be observed that no means are provided on the insulators themselves to prevent the interception of leakage to earth due to moisture on the surface, as in the case of the petticoat in line insulators. This, owing to the position in which the insulators are placed, makes such an arrangement impossible; therefore, a shelter was built over each set, and the entrance of the cable through the end of the house provided with a large window of plate glass with a hole 9 inches in diameter through which the cable passes.

PINCHOT'S SOLILOQUY.

Written for the Journal of Electricity, Power and Gas, with apologies to Shakespeare.

To conserve, or not to conserve, that is the question:
Whether 'tis better for the public to suffer
The grabbing of the coal lands and power sites,
Or for me to take arms against the Government,
And by opposing lose my position: To talk, to serve
No more; and by this talk to say we end
The danger and the thousand ills
That threaten? 'Tis conservation
For which we devoutly wish. To talk, to serve, aye
there's the rub,
For in that talk of service what hopes may come,
When we have overcome this Ballinger,
Must give us pause. There's the respect
That makes calamity of so long life:
For who would bear the whips and scorns of Taft,
The monopolies' wrong, the subordinate's contumely,
The pangs of misjudged zeal, the law's delay,
The insolence of office and the oppression
That the power trust of its enemies takes,
When he himself might his quietus make,
By keeping still? Who would these fardels bear
To grunt and sweat and under a weary life,
But that the hope of something after Taft,
The political convention, from whose bourne
No politician returns, puzzles the will,
And makes us rather bear those ills we have,
In hopes of some day being President.

EXAMINATION FOR COMPUTER.

The United States Civil Service Commission announces an examination on February 16-17, 1910, to fill a vacancy in the position of computer, $1600 per annum, in the Coast and Geodetic Survey, for duty at Manila, Philippine Islands.

THE ATTITUDE OF INVESTORS TOWARD ELECTRICAL SECURITIES.[1]

BY GEORGE B. CALDWELL.

I might say that we meet today on common ground. You are students of electricity and electrical engineering and know better than I do the value commercially of the kilowatt, yet you will, I think, agree with me that if great plants are to be built, old ones rebuilt and the demands of the public satisfied, there is certainly one question more fundamental than that of technical means and methods.

That question is, "How shall the enterprise be financed?" It is there that you, representing the progressive ideas that you do, and the banker handling bonds meet on common ground, and ask the same question, "The Attitude of Investors Toward Electrical Securities."

I will mention a few of the elements that my experience suggests as essential to a marketable bond on an electrical plant.

First—It must not be overbonded, if the bonds are to be sold to the public.

Second—It must have good management.

Third—It must have a depreciation reserve, or sinking fund.

Fourth—Honest accounting.

The attitude of the investor is one seeking security first, income second, and convertibility finally. In this respect your securities are not different than those of other corporations. The difference, as I find it, is this: that electricity is regarded as an element that is less understood than most any other public utility. It is growing very fast in public favor for power and light, yet with this in its favor—backed as it is by a body of professional men—than whom there are none more progressive—the feeling exists that it has not yet been fully developed and that the methods employed for its production and distribution are rapidly changing.

I know investors who will purchase a gas bond who will not buy a bond on an electric plant alone. Their refusal is based, not alone on the plea that the character of apparatus required to produce electricity wears and deteriorates rapidly, but that it has not yet become standardized, thus making an additional risk—a double depreciation.

My own observation and experience is, however, that during the past five years you who are engaged in the science of electricity, as well as those engaged in the manufacture of electrical apparatus, have reached a state of perfection where standard apparatus, at least for light and power, is now to be had, and is so installed and operated as to be a safe business risk for a fifteen or twenty year bond. However, until the attitude of the public mind fully comprehends this, the marketability of electrical securities will be more or less affected by the reasons I have mentioned.

It is right here that you who are engaged in production, and the banker engaged in financing, should work hand in hand, to the end that tests as to the durability and productive power of all modern electrical plants should be clearly and conservatively determined, and the facts freely distributed, especially if securities are to be sold to the public.

[1]An address before the Electrical Club of Chicago.

As to a proper depreciation charge, I, of course, know that varies, and is a question of management or policy with the company itself. I am frank to say to you that until in very recent years this item has been very large—even larger than most operating men were willing to admit in their annual reports. As the operating end of electrical properties comes more and more to be handled by skilled electrical men, this item will grow to be less of a hazard, especially with standard machinery.

A man long connected with the General Electric Company recently assured me that with present day apparatus, where a property was kept up to a high state of efficiency, a depreciation charge of probably 5 per cent, at least 7 per cent, would keep the security good. If this is true, then electrical securities are not different from other industrial enterprises, and compare favorably with the depreciation account on a business block, even in downtown Chicago.

Put into actual practice, it means, however, that an electrical property costing today $250,000, must earn net above operating $25,000 annually to take care of a 5 per cent annual depreciation and pay 5 per cent on the money invested. Such an earning power does not, however, justify a bond issue for more than one-half of the investment, and then only where the franchise situation and management are the best and the public a ready consumer.

There is at least one other thing regarding marketability of electrical securities that is worthy of passing word. The census report of 1892 shows us that the average cost per electric plant was $140,000, while in 1907 it was $200,000—further, the eleven or twelve hundred million dollars invested in electric lighting and power plants is divided among some eight or ten thousand separate companies, with a net earning power of 14 per cent on capital invested.

We have here then a great number of small individual plants, unrelated in management or corporate organization. It is obvious that one must have a very specialized information to be a judge of the character of these innumerable different issues of bonds and stocks, and that the stocks in but a few instances pay dividends, while bond issues, even though conservative, lack in convertibility, which is but another word for marketability. In the main, such bonds bear 5 per cent and 6 per cent.

With the creation of larger corporations, operating conditions should likewise improve, and it is not at all improbable to say that within another five years capital control will itself consolidate many properties, and correct many operating evils, as well as broaden the market. I can illustrate my point no better than by my own experience.

Seldom a day passes but that the owner of a situation in a city of ten or twenty thousand people calls on me to purchase an issue of bonds for rehabilitation and extension of his plant.

Allowing that the margin of security is ample, the market is slow and doubtful, and if sold at all the discount is heavy. Such securities are either sold at home, or handled by small houses, or not at all, and are traded for apparatus and used at the smaller banks as collateral. In any case, it is a most expensive and unsatisfactory method of financing. Money secured in this manner frequently costs from 8 per cent to 10 per cent.

The remedy, so far as modern practice has offered one, comes from and through the large operating company. Here you find capital in control of one organization sufficient to handle many small situations economically and with it a management composed of the best legal and scientific operating talent. That this method is and will be the means of bringing confidence and a safer security to the hands of the investors is conclusive if the history and success attained by the existing holding companies are a criterion, for in every instance coming under my observation they have proven profitable alike to the stockholder and the bondholder.

Right here let me say that I am willing to concede that the business of manufacturing and selling of electrical energy has been almost uniformly profitable, yet it has been so after encountering many expensive obstacles both in engineering and financing. So much progress has been made that I regard a bond issue on a modern electric light plant in cities of fifty thousand and over as only an ordinary business hazard. For such hazard 5 per cent on a bond issue for not over one-half the cost, with a sinking fund provision that will retire the bonds in twenty years, makes a safe investment, providing net earnings power averages twice the interest.

There still exists, however, the questions of management and marketability. With these worked out, as they surely will be, the first by the aid of honest engineering and the last by honest financing—the investing public will have less cause of apprehension. Markets will broaden and prices improve.

In conclusion, I want to say I believe the utilization of our great water powers also tends towards a combined management covering large areas. It has indeed already worked great results in the matter of long distance transmission. Again, the public has pretty well learned that competition in such a field is not what is desired. The Public Utility Commissions, wherever they have become powerful factors in the control of electrical development, are inclined to take that same view and seek to obtain by regulation, rather than by competition, the fair treatment of the public. There is danger that at first Public Utility Commissions will undertake to assume all the functions of management, except the payment of interest and dividends. Just so far as this is done, just so far will initiative be deadened and development hampered.

Personally, I am not fearful of such a tendency. We are on the whole in favor of fair play and a very sensible people. We believe in business initiative. Intelligent management of properties, whether by a corporation acting with a commission, or without, already recognizes that it is the part of wisdom to give to their customers good service at reasonable cost. It is in the application of this principle, as well as in the use of the modern dynamo, for which you are responsible, that has made it possible for the electric business to double in five years. Given intelligent technical management, conservative accounting and a liberal interpretation of consumers' rights, and I see no reason why funds should not be found that will absorb all the securities of this character which it will be found necessary to create.

THE MELVILLE-MACALPINE REDUCTION GEAR.[1]

BY CHAS. F. SCOTT.

The most striking feature of the new spur-wheel reduction gear for high-speed steam turbines, which is attracting such wide attention, is its simplicity. There is no novel chain drive; no electrical nor hydraulic auxiliary. At first sight it is simply a common double helical gear of ordinary form. The supplemental element adds nothing to the principle of the gear, but is simply a means of overcoming the difficulties of the ordinary gear. The difficulty in a large gear does not lie in its ideal normal action, but in the impossibility of securing and maintaining the necessary mechanical perfections; hence, internal and abnormal forces result in friction, destructive wear or breakage. Obviously, if some device could provide a flexible or automatic adjustment which would do away with these internal stresses, a large high speed gear would be practicable. Apparently it was some such reasoning as this that led to a simple solution of the problem and produced the unexpected and almost incredible results which have been obtained. It is interesting to note that a gear with ten per cent loss was considered admissible, that the arrangement for testing the present gear had been made suitable for the measurement of a loss of about five per cent, and that these methods had to be modified when the loss was found to lie between one and two per cent.

So simple a thing as a large spur-wheel gear may not at first sight appear of unusual consequence or excite enthusiasm. There are, however, several notable conditions which are involved. The gear concerns the efficient generation of power in large units. The industrial and commercial progress of the past century has been dependent upon the generation of power and each new step in the means for producing and transmitting power has opened up new fields of activity.

The steam turbine has had two fields of application—the electric power house, where it has, in a few years, almost wholly superseded large reciprocating engines; and high speed vessels. In the latter the turbine has been run at an inefficient speed, and yet it is taking the place of the reciprocating engine; now, the more efficient turbine and gear are applicable to both high speed and low speed vessels.

In ocean traffic the sailing vessel began to be supplemented by the steam ship with a simple steam engine some eighty or ninety years ago. About 1865 the compound engine opened the way for a new class of ocean-going vessels. The triple expansion engine followed some twenty years later, giving new power capacity and enabling larger sizes of vessels and higher speeds to be attained. About ten years ago the turbine was first introduced for marine purposes, and soon came the Lusitania and the Mauretania. When the Great Eastern was built in the fifties, it was a practical failure because its machinery and its fuel took so much room that there was little left for cargo—although much smaller than the Lusitania, it required more than twice as much coal.

In this new gear the simple "floating frame," which allows the automatic alignment of the pinion shaft, has removed the old limits of size and weight and efficiency in the prime movers which have been the controlling factors in steam navigation. One of the most striking features of the presentation by Mr. Westinghouse is the summary of the indirect advantages in construction, economy and cargo capacity which are made possible in the design of vessels under the new conditions.

In the electric power station, the electric generator and the electric system transform the enormous power of the turbine, run at its most efficient speed, which is quite unsuited for direct application, and transmit and distribute the power in small units at moderate speeds for ordinary and varied service. On shipboard transmission and distribution are not required, and electric machinery would be cumbersome and heavy. The gear is the adjustable link which allows the turbine and the screw each to work at its own best speed. Each is free and unrestricted; the old limits are removed and a new era of possibilities appears in marine construction, where tens of millions of horsepower require annually tens of millions of tons of coal in the international commerce of the world. The reduction gear may be a factor in the conservation of natural resources. On land, the development of water-power saves the consumption of coal; on sea, fuel alone can be used, hence the only way to save coal is by higher efficiency in its use.

The reduction gear is, of course, suitable for other applications than those on shipboard. A promising field is the operation of large, slow-speed, direct-current generators by high-speed turbines, as the direct-current generator does not readily lend itself to high speeds in large sizes.

[1]The Electric Journal.

EFFECT OF ELECTRICAL TRANSMISSION.

The statement is frequently made that water powers have increased in value since it became possible to transmit power electrically. Charles T. Main, mill engineer and architect, Boston, Mass., points out in a recent paper that to be correct the statement should be modified. Since the introduction of electrical transmission many water powers which were before unavailable and valueless have been developed and become of value, and many others will be in the future, but water powers which have been developed and the power used adjacent thereto have, as a rule, not increased in value.

To the cost of the development must be added the cost of the electrical apparatus and pole line to a point where the power is to be used, and this is a large item of expense in long-distance transmission. Usually, also, there must be added to the cost of the physical part of the plant a considerable amount for right of way for pole line, legal expenses, and cost of financing.

To the running expenses must be added the fixed charges for the electrical apparatus and pole line, and the cost of running and maintaining the same. A correction must also be made for the loss of power in transmission.

A comparison of the cost of producing and transmitting power can be made with the prices which can be obtained for this power to determine if the development has any value, and whether the development is warranted or not.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE

Technical Publishing Company

E. B. STRONG, President
A. H. HALLORAN, Vice President and Managing Editor
C. L. CORY, Secretary.

DIRECTORS

R. J. DAVIS A. M. HUNT A. H. HALLORAN C. L. CORY E. B. STRONG

604 MISSION STREET, SAN FRANCISCO

TELEPHONE - - - - - - - - - KEARNY 918

TERMS OF SUBSCRIPTION

United States, Cuba and Mexico	per year.	$2.50
Dominion of Canada	"	3.50
Other Foreign Countries within the Postal Union	"	5.00
Single Copies, Current Month	each	.10
Single Copies, prior to Current Month	"	.25

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office *ten days in advance of date of issue.* New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Electrical Equipment of Columbia Theater....71
By W. W. Hanscom.
The Carquinez Span....74
Pinchot's Soliloquy....79
Examination for Computer....79
The Attitude of Investors Toward Electrical Securities....79
By George B. Caldwell.
The Melville-Macalpine Reduction Gear....81
By Chas. F. Scott.
Effect of Electrical Transmission....81
Editorial....82
Notes.
A Cogent Analogy.
Personals....83
Portland Section, A. I. E. E....83
Pacific Coast Electrical Exposition....83
Pacific Coast Electric Vehicle Association....83
Removal Notices....83
Trade Notes....83
Patents....84
Dynamo Electric Machine.
Reduction Gearing.
Electric Laundry Iron.
Elastic Fluid Turbine.
Electrical Apparatus for Melting Sealing-Wax.
Industrial....85
Alternating Current Portable Drill.
The Three-Voltage Rating of the Mazda Lamps.
New Installation by General Electric Co.
Recent Sales of the Crocker-Wheeler Co.
Approved Electrical Devices....87
News of the Stationary Engineers....88
San Francisco No. 1.
California No. 2.
N. A. S. E. Convention.
Practical Mechanics.
Trade Notes....89
News Notes....90

Electric lighting has come to play such an important part in theatrical productions that its absence would be more keenly felt than that of the leading man. The details of its application to the newest of the Pacific Coast theaters, the Columbia, cannot but be of interest, especially as described elsewhere in this issue by the engineer who designed the layout, Mr. W. W. Hanscom.

Engineering attention during the past week has been centered on the aviation meet at Los Angeles. Record flights have been made for both height and distance, but like the wireless records, these marks are no sooner set than they are eclipsed. At present the aviator is to be classed among sportsmen, as the commercial applications of the flying machine, except as a crowd-gatherer, are yet undeveloped.

As told in these columns last week, the great span of the Pacific Gas & Electric Company across the Carquinez Straits was recently the scene of an unfortunate death. Incidentally the resulting short circlit set fire to the wooden cross-arms and it was only after the most strenuous efforts that the span was saved from destruction. In consequence the article that we print this week has a news interest aside from its descriptive value.

A Cogent Analogy

In his recent message to Congress, President Taft has frankly recognized the corporation as being inevitable for the proper transaction of modern business. It would be well if every one else would as squarely acknowledge its necessary existence for the present and cease bewailing the passing of the old regime. It is far more profitable to adapt ourselves to conditions as they are than to attempt the quixotic task of changing them to others that may be more chaotic.

A great machine with its intermeshing gears is cognate to the mechanism of a great business, which is ceaselessly grinding out wealth by the aid of human cogs. It is impossible for every one to be a prime mover, and recognition of the fact that a machine is no stronger than its weakest cog should spur on the weaker ones. The breaking of a cog in a machine usually means but a temporary stop until another can be substituted, although occasionally it does much damage if it gets among the gears. Men of executive ability are the drivers; others the driven. Some of the more capable inter-mesh with so many, that they represent not one, but many cogs, constituting a complete gear in themselves. Success comes to those tactful men whose cogs easily slide into mesh with others when a change is made. Why not at least be an efficient cog?

PERSONALS.

R. B. Daggett returned to San Francisco from the East this week.

T. Hause, electrician of Napa State Hospital, visited San Francisco this week.

H. L. Hibbard, electrical engineer with the Cutler-Hamner Mfg. Company of Milwaukee, Wis., is in San Francisco.

T. C. Rylands, owner of the Sonoma Valley Company of Sonoma, has been spending aviation week in Los Angeles.

G. I. Kinney, manager of the San Francisco offices of the Fort Wayne Electric Co., left for the Northwest this week.

A. L. Valentine has been re-appointed superintendent of public utilities for the city of Seattle, to serve for the next three years.

Walter B. Gump, mechanical and electrical engineer, spent part of this week in San Francisco on his way from Tacoma to Los Angeles.

W. J. Davis, Jr., Pacific Coast electrical engineer for the General Electric Company, left this week for New York on a visit to the factory at Schenectady.

F. C. Finkle, consulting engineer, announces the removal of his office from rooms 230-231 I. W. Hellman Building, to 628½ South Spring street, Los Angeles, Cal.

A. M. Klingman and L. S. Twomey, illuminating engineers with the National Electric Lamp Association, are visiting the Pacific Coast, with headquarters in Oakland, Cal.

F. A. Richards has arrived in San Francisco from the East to assume the position of manager of the car department of the Pierson-Roeding & Company of San Francisco.

Alfred Kendall, manager of the Sydney, Australia, office of the General Electric Company passed through San Francisco this week on his way to the factory at Schenectady.

Thomas Mirk of Hunt, Mirk & Co., has returned from a trip to Southern California, where some important contracts are pending in the line of steam-driven power plants.

A. A. Rogers, manager of the Denver office of the Westinghouse Machine Company, and D. W. Belden, manager of the El Paso office of the same company are in San Francisco.

Frank H. Trumbull, for six years salesman with the Trumbull Electric Mfg. Co., is now associated with Samuel H. Taylor of the Electric Railway & Mfg. Supply Co. of San Francisco.

C. L. Anderson, formerly assistant foreman for the Oregon Electric Company, is now superintendent of the overhead construction for the Astoria Electric Company at Astoria, Oregon.

Chas. Fisk recently resigned as chief clerk of the San Francisco offices of the Western Electric Company to go to London, England, as assistant manager of the Western Electric Company, Limited.

F. J. Leonard, electrical engineer for Swift & Co. of Chicago, who has just finished up the large plant of the Union Meat Company in Portland, passed through San Francisco last week on his return trip.

G. A. Richardson, formerly with the Houghton County Traction Company, Houghton, Mich., has been appointed assistant superintendent of transportation for the Seattle Electric Company, of Seattle, Wash.

C. W. Scott has resigned as manager of the San Francisco office of H. W. Johns-Manville Company, to become manager of the Asbestos Mfg. and Supply Company of San Francisco. Mr. Scott left for the East this week.

O. S. Wakeling, formerly with Baker & Hamilton of San Francisco and recently sales manager for the Caldwell Bros. Co. of Seattle, has opened offices with A. F. Blair as mining and mechanical engineers, in the Mutual Life Building, Seattle, Wash.

J. A. Lighthipe, electrical engineer, with the Edison Electric Company of Los Angeles, has returned to Southern California, after spending a week in San Francisco. While there he inspected the Southern Pacific Company's new electric railway power station in Alameda county and other new installations in the vicinity.

C. W. Hutton, electrical engineer, has become associated with Sanderson & Porter, and has taken charge of the construction of the new Bay Shore sub-station of the Sierra & San Francisco Power Company adjoining the Martin Station of the California Gas & Electric Corporation in the Visitacion Valley, south of San Francisco.

PORTLAND SECTION A. I. E. E.

The January meeting of the Portland Section A. I. E. E. was held in the Knights of Pythias Hall at Eleventh and Alder streets, Tuesday evening, January 18, 1910. The following papers were presented on industrial power subjects: F. F. Barbour, "Irrigation"; J. J. Brady, "Electric Drive in Car Shops"; C. C. Crawford, "Individual and Group Driven Machine Tools"; A. W. Cochran, "Printing Press"; R. F. Monges, "Mining Work"; L. Quimby, "Saw Mills"; C. B. Smith, "Electric Hoists and Cranes in Mining Work"; H. R. Wakeman, "Conditions of Motor Application on Large Lighting Systems"; E. A. West, "Electric Furnaces."

L. B. CRAMER, Secretary.

PACIFIC COAST ELECTRICAL EXPOSITION.

Work on the re-building of the new Coliseum being now under way, under contracts which call for its completion during the month of March, it has been decided to hold the Electrical Exposition about April 1st. The date for the opening of the Exposition will not be named until work on the building is further advanced.

The Chicago Exposition closes January 29th, and the committee has taken into consideration the time required for the transportation to the coast of exhibits shown a Chicago, a number of which will be transferred intact to this point. The fact that the new Coliseum Building will be opened by the Electrical Exposition will give opportunities for publicity of which we will take every advantage.

Exhibitors will be interested in knowing that both the "Electrical World" and "Electrical Review" have contracted for space and will have special Eastern representatives in charge, who will cover the entire exposition with elaborate reports, fully illustrated.

PACIFIC COAST ELECTRIC VEHICLE ASSOCIATION.

In view of the fact that the Pacific Coast Electrical Exposition is to be held in San Francisco early in April, 1910, the members of the Pacific Coast Electric Vehicle Association have decided to postpone their annual meeting to that time and place. Exhibits of electric vehicles will be made at the show by most of the prominent manufacturers and the list of papers to be read insures an interesting meeting.

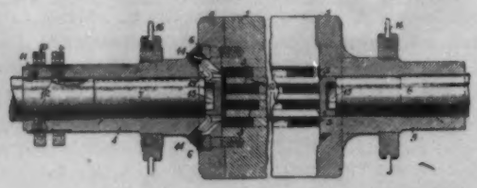
REMOVAL NOTICE.

The Portland Elevator Company recently moved to larger quarters at 5 to 7 First street, Portland. This company is now manufacturing its own controllers.

The San Francisco offices of the American Electric Fuse Company of Muskegon, Mich., will be moved from 121 Second street, to 143 Second street, on January 24. The new offices greatly increase the floor space and provides better facilities for handling the large stock which has been installed.

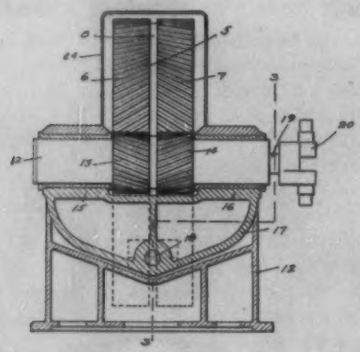
PATENTS

945,425. Dynamo-Electric Machine. Egbert M. Tingley, Pittsburg, Pa., assignor to Westinghouse Elec. & Mfg. Co. A rotatable member for dynamo-electric machines, comprising a magnetizable core having a magnetizing winding disposed in



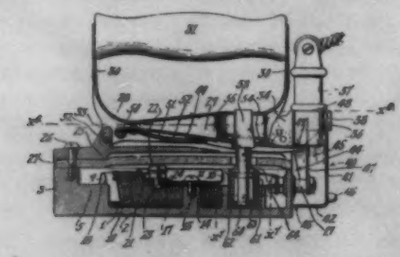
centrally located parallel and longitudinal planes, flanged coupling sleeves of non-magnetizable material clamped to the ends of the core, shaft sections the inner ends of which are seated in said coupling sleeves and soft metal blocks interposed between the ends of the shaft sections and the core.

946,456. Reduction-Gearing. George W. Melville and John H. Macalpine, Philadelphia, Pa. In reduction gearing, a gear, a pinion meshing therewith, a frame carrying said pinion and a pin for pivotally mounting said frame and provided with bearings on opposite sides of the plane including the axis of said



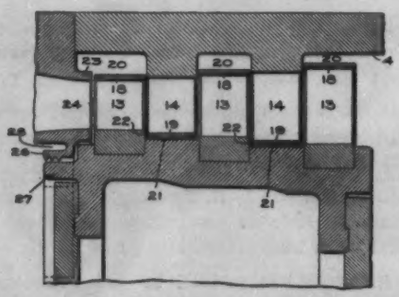
pinion and perpendicular to the plane including the axes of the gear and pinion so that said frame is capable of being swung by the tooth pressures during the operation of the gearing to permit of the automatic distribution of such pressures.

946,070. Electric Laundry-Iron. Earl H. Richardson, Ontario, Cal., assignor to Pacific Electric Heating Company, Ontario, Cal. In an electric laundry iron, a hollow body, a plu-



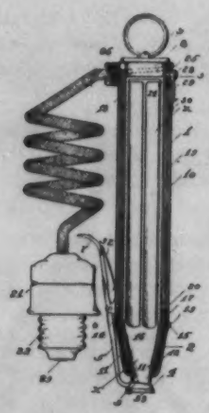
rality of electric heating units therein, means engaging the ends of the units for preventing their lateral movement in either direction, and a plate above the bottom of the body and detachably secured thereto, said heating units being interposed between said plate and the bottom of said body, whereby said plate exerts a vertical downward pressure on said units, holding them in close contact with the bottom of the body.

945,919. Elastic-Fluid Turbine. Charles G. Curtis, New York, N. Y., assignor to General Electric Company. In an elastic-fluid turbine, the combination of a rotor having rows of buckets, a stator also having rows of buckets located between those of the rotor, the rotor buckets acting to extract velocity from the motive fluid without substantial conversion of pressure into velocity while the stator buckets direct the fluid and



act to convert pressure into velocity, covers for the buckets, those of the stator being located in close proximity to the rotor and beyond the path of the fluid jet to provide a restricted clearance to reduce leakage while those of the rotor are widely separated from the casing and have an unrestricted clearance, a nozzle for discharging fluid against the first row of buckets, a casing for the turbine, and an exhaust conduit.

945,822. Electrical Apparatus for Melting Sealing-Wax. William T. Von Tillow, San Francisco, Cal. An electric sealing-wax melting apparatus consisting of a tube having a tapered end and a restricted opening; an exteriorly mounted pivoted gate adapted to close said opening; an outer casing



concentrically spaced from said tube; a heating device consisting of an electro-thermal resistance encompassing said tube adjacent the said restricted opening; an insulator for said resistance; suitable electric connections between said electro-thermal resistance and the source of energy; and a suitable switch interposed in the electric circuit.

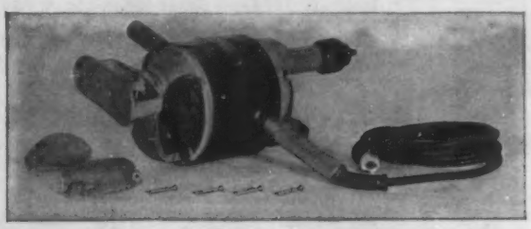
INDUSTRIAL

ALTERNATING CURRENT PORTABLE DRILL.

In the present day of skilled labor, high speed machinery, and plants of vast size, the minutes become a question of great moment. Fortunes have been made from the scrap heap, the profits of manufacturing plants have been enormously increased by the discovery of a method of turning waste into valuable by products. Will the moments wasted slip by unnoticed? Time is money. Profits depend upon the amount of business done. Economy of time must become a question of supreme importance to the large manufacturer or moments wasted will total an appalling amount.

The practice of taking heavy castings to a stationary drill, of spending much valuable time in adjusting them in order that a few brief moments may be spent in drilling is an instance of the wasteful methods that eat into the profits.

The direct current portable breast drill designed by the General Electric Company has met with great favor and has so satisfactorily demonstrated its ability to do the work for which it was designed that they are now manufacturing



Alternating Current Portable Drill with Cover Removed.

an alternating current one which possesses all the superior features of their direct current drill and permits the use of this device where alternating current only is available.

It possesses the ruggedness of design required to withstand the hard usage incidental to its service, yet its weight has been reduced to a minimum, being but 21 pounds, ensuring that the device may be handled by one person with great ease and rapidity. Two gnurled side handles and a breast plate provide ample means for holding it securely in any position.

An indicating control switch for starting and stopping the motor is located conveniently near the right handle so that it can be operated by the right hand without releasing the hold on the right handle. This feature makes control of the apparatus so simple that the whole attention may be given to the operation of the drill. Hand holes are provided which furnish a means of easy access to the commutator and brushes for inspection and repairs if necessary.

The drill is fitted with a jacob's chuck which will take drills up to and including ⅝-inch in diameter. An idea of the great saving of time made possible by its use may be gained from the following approximate data. It will drill a⅝-inch hole 1-inch deep in cast iron in 27 seconds; in machine steel in 95 seconds. It will also satisfactorily operate a ¾-inch wood bit.

Compare this with the time required to move heavy castings to a stationary drill, adjust them, drill one hole, adjust again, drill another, etc. In general a crane will be required necessitating the services of several men in addition to the one operating the drill. In many cases the same work could be done in a few minutes by one person with a portable drill. It is designed for operation on a 110 or 220 volt, 60 cycle circuit to which it is connected by screwing the attaching plug into a standard lamp socket.

THE THREE VOLTAGE RATING OF MAZDA LAMPS.

The Mazda incandescent lamp when operated at an efficiency of 1.25 w. p. c. has proven itself far more economical than either carbon, gem or tantalum lamps on all costs of energy above a few cents per kw. hour. There are some cases, however, in which the cost of energy per kw. hour is very low, perhaps a small fraction of a cent. In such cases a cheaper and less efficient lamp may show greater economy in operating expense than the Mazda lamp operated at 1.25 w. p. c. The somewhat higher renewal expense of the latter lamp at this efficiency may not be counterbalanced by even a great reduction in the amount of current used where the current is cheap. Since the Mazda incandescent lamp is inherently of higher efficiency and quality, the question of its economical application to any particular case merely depends upon its operation at the correct efficiency. In the case just cited, a small sacrifice in efficiency of the Mazda lamp could be made in order to reduce the renewal expense and thus secure greater economy than could be obtained with the other types of lamps even on very cheap power. Besides the actual saving in current made possible through the use of the Mazda lamp there is the very important possibility of releasing generating capacity, which even where the operating cost is low, may often be of great value. This point should not be overlooked in deciding the relative economy of high efficiency versus low efficiency lamps.

The incandescent lamp manufacturers have recently made a radical change in their methods of rating these lamps, in order that the lamps could be used with greater economy under those certain conditions, where heretofore their cost of operating exceeded that of a less efficient type of lamp and is most valuable in cases where the cost of electrical energy is low. The new method of rating called the "three voltage plan" is based upon the fact that for any given set of conditions, depending upon the cost of energy and cost of lamp, there is one particular efficiency and life at which it is most economical to operate a given lamp. Each Mazda lamp is labeled with three voltages two volts apart, as for example: 114, 112, 110, called top, middle and bottom voltage respectively.

This method of rating makes it possible for a customer to select the particular efficiency of lamp he wishes to use by specifying that either the top, middle or bottom voltage, as the case may be, should be the same as that of his lighting circuits.

When burned at top voltage the Mazda lamp has the highest efficiency or consumes the least energy for the light produced, and gives life of 1000 hours. At middle voltage more energy is consumed per candlepower produced and the life is lengthened (due to operation at a lower temperature) to 1300 hours. At bottom voltage the lamp is operating at lowest efficiency and gives a life of 1700 hours. It is obvious that the relative cost of lamp and energy will determine the most economical life and efficiency, since if energy is cheap the saving in energy obtained by operating the lamp at high efficiency is not sufficient to counterbalance the higher resulting renewal expense. On the other hand, if energy is relatively expensive, then it will be desirable to operate the lamp at a high efficiency, since the saving in current at the higher rate will more than pay for the increase in renewal expense.

The efficiency of the different sizes of lamps at top voltage is not the same, since the larger lamps are relatively longer lived than the smaller ones, and, in order to give all sizes a uniform life of 1000 hours at the top voltage, it was necessary to operate the 25 watt lamp at 1.33 watts per candle, the 40 watt lamp at 1.25 w. p. c., the 60, 100 and 150

watt lamps at 1.20 w. p. c. and the 250 watt lamp at 1.15 w. p. c. The advantage of the new plan will be apparent by referring to the Table No. 1 showing the cost of producing light with Mazda lamps. This table is based on list price of bowl frosted Mazdas, and shows the total cost of operating the several sizes at top, middle and bottom voltage with costs of energy from 1c to 20c per kw. hour. The total cost given in the table includes the cost of the energy consumed and the renewal expense involved in the production of a quantity of light equivalent to 100,000 lumen hours (which is equal to about 10,200 mean horizontal candle hours in the case of the Mazda lamp).

bottom voltage will then show economy for the Mazda lamps over either carbon, gem, or tantalum down to energy costs as low as 0.2c per kw. hour.

Table No. 2 shows the comparative cost of producing 100,000 lumen hours with carbon, gem, tantalum and Mazda lamps with costs of energy from 0.2c to 1c per kw. hour. This table is based on conservative total life values of the carbon and gem lamps in place of the usual useful life, since practically all lamps are left in service until ultimately burned out, rather than till they drop to 80 per cent of initial candlepower. The Mazda lamps have all been taken at bottom voltage, and the gem lamp has been figured in the same way as

Table Showing Total Cost of Producing Light with Tungsten Lamps at Top, Middle and Bottom Voltages on Various Costs of Power

Nominal Watts	25			40			60			100			150			250		
Nominal C. P.	20			32			48			80			120			200		
Voltage	Top	Middle	Bottom	Top	Middle	Bottom	Top	Middle	Bottom	Top	Middle	Bottom	Top	Middle	Bottom	Top	Middle	Bottom
Watts per candle.	1.33	1.39	1.45	1.25	1.30	1.35	1.20	1.25	1.30	1.20	1.25	1.30	1.20	1.25	1.30	1.15	1.20	1.25
Actual watts	25.0	24.2	23.3	40.0	38.9	37.8	60.0	58.0	56.5	100	98.0	94.2	150	145.5	141.2	250	242.5	235
Actual c. p.	18.8	17.4	16.1	32.0	29.9	28.0	50.0	46.5	43.5	83.3	77.6	72.4	125	116.4	108.6	217.3	202.0	188.0
Total lumens	184.2	170.5	157.8	309.8	289.4	271.0	490.0	455.7	426.3	816	760	710	1225	1141	1064	2104	1954	1819
Lumens per watt	7.36	7.05	6.77	7.74	7.44	7.17	8.16	7.86	7.54	8.16	7.76	7.54	8.17	7.84	7.54	8.41	8.05	7.74
Hours life	1000	1300	1700	1000	1300	1700	1000	1300	1700	1000	1300	1700	1000	1300	1700	1000	1300	1700
Kwh. cons. per 1000 hrs.	25.0	24.2	23.3	40.0	38.9	37.8	60.0	58.0	56.5	100	98.0	94.2	150	145.5	141.2	250	242.5	235
Cost of frosted lmp	$0.75	$0.75	$0.75	$0.85	$0.85	$0.85	$1.17	$1.17	$1.17	$1.55	$1.55	$1.55	$2.25	$2.25	$2.25	$3.20	$3.20	$3.20
Lamp rnwl per 1000 hrs.	.75	.58	.44	.85	.65	.50	1.17	.90	.69	1.55	1.19	.91	2.25	1.73	1.32	3.20	2.46	1.88

Combined Cost of Power and Lamp Renewals per 100,000 Lumen Hours in Dollars

Variable Cost of Power Cents per K. W. H.																		
	1.	$0.54	$0.48	$0.42	$0.40	$0.36	$0.32	$0.36	$0.32	$0.29	$0.31	$0.29	$0.26	$0.31	$0.28	$0.26	$0.27	$0.25	$0.23
	2.	.68	.62	.57	.53	.49	.46	.48	.45	.43	.44	.41	.39	.43	.41	.39	.39	.37	.36
	3.	.81	.76	.72	.66	.63	.60	.61	58	.56	.56	.54	.52	.55	.53	.52	.51	.50	.49
	4.	.95	.90	.87	.79	.76	.74	.73	71	.69	.68	.67	.66	.67	.66	.65	.63	.62	.62
	5.	1.09	1.04	1.02	.92	.90	.88	.85	83	.82	.80	.80	.79	.80	.79	.79	.76	.75	.75
	6.	1.22	1.18	1.17	1.05	1.03	1.02	.97	.96	.96	.92	.92	.91	.92	.92	.92	.86	.87	.88
	8.	1.49	1.47	1.46	1.31	1.30	1.30	1.22	1.22	1.22	1.17	1.19	1.19	1.16	1.17	1.19	1.10	1.12	1.14
	10.	1.75	1.75	1.76	1.57	1.57	1.58	1.46	1.47	1.49	1.42	1.45	1.46	1.41	1.43	1.45	1.34	1.36	1.40
	12.	2.03	2.04	2.05	1.82	1.84	1.86	1.71	1.72	1.75	1.66	1.70	1.72	1.65	1.68	1.72	1.58	1.62	1.65
	16.	2.57	2.59	2.64	2.34	2.37	2.42	2.20	2.23	2.28	2.15	2.22	2.25	2.14	2.19	2.25	2.05	2.11	2.17
	20.	3.12	3.16	3.28	2.86	2.91	2.97	2.69	2.74	2.81	2.64	2.73	2.78	2.63	2.70	2.88	2.53	2.61	2.69

Reduction factor—25—60—100—150 watt lamps=78 per cent.
40—250 watt lamps=77 per cent.

TABLE No. 1.

In order to see how the most economical efficiency varies with the cost of energy refer to Table No. 1 and consider, for example, the cost of producing 100,000 lumen hours with a 60 watt Mazda at the top, middle and bottom voltage with energy varying from 1c to 20c per kw. hour. With the 60 watt lamp and with energy at 1c per kw. hour, 100,000 lumen hours can be produced most cheaply if the lamp is operated at the bottom voltage. The difference between the cost at top and bottom voltage with this cost of energy being about 19 per cent. At 5c energy the bottom voltage is still the cheapest

this is the most economical voltage for such low costs of energy. The average candlepower and watts during the life values shown have been taken in every case rather than the initial values. This has been done because the Mazda lamp maintains its candlepower much better than the other types, which is a distinct advantage in its favor and should be considered in comparing it with other types of lamps. The costs of lamps taken in this table are those for clear lamps in standard package quantity.

For energy costs above 5c or 6c any percentage saving

Comparative Cost of 100,000 Lumen Hours, Carbon—Gem—Tantalum—Tungsten Lamps, with Energy Below 1 cent per K. W. H.

	Carbon		Gem	Tantalum	Tungsten					
Rating	16 c.p. 3.1 w.p.c.	16 c.p. 3.5 w. c.p.	20 c.p. Bot. Vltg.	20 c.p. 2 w. p. c. —d. c.	25 w.	40 w.	60 w.	100 w.	150 w.	250 w.
							Bottom Voltage.			
Actual initial c. p.	16	16	167	20	16.1	28.0	43.5	72.4	108.6	188.0
Actual initial watts	49.6	56	47.3	40.0	23.3	37.8	56.5	94.2	141.2	235.0
Nominal w. p. c.	3.1	3.5	2.83	2.00	1.45	1.35	1.30	1.30	1.30	1.25
Hours life	800	1700	1450	1200	1700	1700	1700	1700	1700	1700
Average c. p. during life	13.20	13.06	14.00	21.66	16.46	28.30	42.60	71.50	107.2	179.7
Average watts during life	48.6	54.9	40.2	41.0	23.9	38.6	55.6	92.6	138.8	241.3
Reduction factor	82.5	82.5	82.5	79.0	78	77	78	78	78	77
Lumens	138	135	145	215	161	274	417	701	1051	1739
Cost of lamp std. pkg.	$0.18	$0.18	$0.225	$0.405	$0.567	$0.648	$0.891	$1.175	$1.701	$2.430
COST OF POWER—CENTS PER K. W. H. 2c.	$0.233	$0.160	$0.162	$0.195	$0.237	$0.167	$0.152	$0.125	$0.122	$0.110
3c.	.269	.200	.190	.214	.252	.181	.166	.138	.135	.124
4c.	.303	.241	.218	.233	.266	.196	.179	.151	.148	.138
5c.	.339	.282	.246	.253	.281	.210	.192	.165	.161	.152
6c.	.374	.323	.273	.272	.296	.224	.206	.178	.175	.166
8c.	.445	404	.329	.310	.326	.252	.232	.204	.201	.193
10c.	.515	.485	.384	.348	.355	.280	.259	.231	.207	.221

TABLE No. 2

but is now only about 3 per cent cheaper than at top voltage. At 8c per kw. hour the top and middle voltages are as cheap as the bottom voltage and above 8c the top voltage is the most economical. Where the per cent saving possible to obtain by operation at bottom voltage is slight, as for example is the case just considered with energy above 5c per kw. hour, it is far better to use the lamps at top voltage and thus secure not only a better quality of light but more light from a lamp of given size as well.

The greatest benefit can be derived from the three voltage plan, however, on the low costs of energy, where operation at

that it is possible to obtain by operating the Mazda lamps at other than top voltage becomes so small as to be negligible in comparison with the better quality of light obtained at the higher voltage. Only in those cases where energy is very cheap should anything but top voltage be seriously considered. For ordinary use on central station circuits on the usual central station rates, top voltage should always be used. The prime object of the three voltage plan, as applied to Mazda lamps, was to widen the field of its commercial application by making it competitive with the cheaper and less efficient lamps on low cost of energy.

NEW INSTALLATIONS BY THE GENERAL ELECTRIC CO.

The General Electric Co., through their San Francisco and Seattle offices, have contracts for installing a number of interesting electrical equipments in mines. These include a 400 h. p. induction motor, 440 volts, to be installed at the South Eureka Mine, Sutter Creek, Cal., and a 2600 k. w. hydroelectric plant at Sheep Creek, Alaska, for the Alaska Treadwell Mining Co. This power is to be transmitted to the mines on Treadwell Island at 2300 volts through a submarine cable.

The General Electric Co. is also installing for the White Pass and Yukon Railway at Skagway, Alaska, two type AQB 100 k. w., 3600 r. p. m., 2300 volt, horizontal Curtis turbine generating sets with direct connected exciters and two water-driven units, 250 and 125 k. w., respectively. The generators are two phase, 60 cycle machines.

The Whatcom County Railway and Light Co., whose steam plant at Bellingham, Wash., was recently changed to oil-firing, is installing an additional 2000 k. w., 2500 k. v. a., 1800 r. p. m., 2300 volt horizontal Curtis steam turbine generating set supplied by the General Electric Co.

RECENT SALES OF THE CROCKER-WHEELER COMPANY.

Recent sales of the Crocker-Wheeler Company aggregate more than 5000 horsepower in direct current motors and approximately 2000 k. w. in direct current generators and 2000 k. v. a. in a. c. generators. Prominent among these sales is one to the Bethlehem Steel Company of South Bethlehem, Pa., calling for five compound wound interpole motors with a total output of 3600 h. p. Two of these machines have a capacity of 1000 h. p. each at a speed or 285 r. p. m. This company has also ordered 19 of the well known C-W mill motors with a compound capacity of nearly 800 h. p. These orders will be an addition to the present equipment at the Bethlehem Steel Company's works of 10,900 h. p. in C-W motors. Another order calls for one 1200 k. v. a. a. c. generator to be used for light and power in the plant of the Miami Copper Company, Globe, Ariz. This generator is to operate at 107 r. p. m. and furnish 25 cycle, 3-phase current at 6600 volts. Among the orders for alternating current apparatus is one for the plant of the Virginia Bridge & Iron Company, calling for two 200 k. v. a. 200 r. p. m., 60 cycle, 3-phase, 2300 volt synchronous motors. This concern has also ordered one 50 h. p. compound wound, 230 v. direct current motor. Other important sales are as follows:

Two 2300 volt, 60 cycle, 3-phase alternators with a combined capacity of 280 k. v. a. to be shipped to the Weston Electric Light Company, Weston, Mass.; one 600 k. v. a., 600 volt, 171 r. p. m., 3-phase alternator for the Landes, Frary & Clark Company, New Britain, Conn. A 1500 k. v. a. generator is at present being constructed for this company; one 250 k. w., 200 r. p. m., 550 volt generator for the Burton Powder Company, Quaker Falls, Pa.; two 250 volt d. c. generators with a total capacity of 200 k. w. for the Flannery Bolt Company, Bridgeville, Pa.; two 250 k. v. a., 60 cycle, 3-phase, 480 volt generators, sixteen 20 h. p., induction motors, three 50 k. v. a. 440/110 volt, 60 cycle transformers, one 35 k. w., 125 volt, d. c. generator, and one 25 k. w. motor generator set for the Textile Building Company of Clifton, N. J.; sixteen 500 volt d. c. motors with a total of 197 h. p. and one 90 k. w. generator to be shipped to the E. D. Jones & Sons Company, Pittsfield, Mass.

The Portland (Ore.) Railway, Light & Power Company is again increasing the capacity of its hydroelectric plant. It has recently placed an order with Allis-Chalmers Company for a 3750 k. w. water wheel type 11,000 volt, 60 cycle, 3-phase, 360 r. p. m. alternator. This will be of the same general design as the 2500 k. w., 11,000 volt, 33 cycle alternators already supplied by the same company, and will be semi-enclosed. A 50 k. w., 120 volt exciter will be direct connected to an extension of the alternator shaft.

APPROVED ELECTRICAL DEVICES

CONDUIT BOXES.

Pressed steel outlet boxes for use with rigid conduit, sherardized or enameled finish. Cat. Nos. 3-R, 3-RB, 4-C, 4-CB, 4-CE, 4-RF, 4-R, 4-RD, 4-RR, 4-RDD, 4-SC and 4-S. "Unilets." Cast iron and pressed steel boxes for use with rigid conduit, with steel or porcelain covers or with porcelain bushings in sides. Types 1-12 inclusive and 14. "No-Thread" Outlet Boxes. Pressed steel outlet boxes provided with an outlet coupling secured to the box which permits the box to be used with unthreaded conduit. Approved Jan. 3, 1910. Manufactured by

Appleton Electric Company, 212-214 N. Jefferson St., Chicago, Ill.

CONDUIT OUTLET BUSHINGS AND COUPLINGS.

"No-Thread" Outlet Coupling. A sherardized fitting for securing outlet boxes to unthreaded conduit. Approved Jan. 3, 1910. Manufactured by

Appleton Electric Company, 212-214 N. Jefferson St., Chicago, Ill.

FIXTURES.

"All-Ways" Portable Desk Fixture. A fixture provided with a device for adjusting the position of the lamp both horizontally and vertically. This is accomplished by means of a collapsible arm pivoted on the base of the fixture. The wiring is exposed and is carried along the arm through eyelets secured to the rivets used in assembling the arm. Approved Jan. 3, 1910. Manufactured by

American Electric Company, 6500 State St., Chicago, Ill.

RHEOSTATS.

All capacities, 125-500 V. Motor starters, CR-107 and CR-109 (Type SA). Motor starters with field control, CR-162 (Type SFA). Speed regulating, continuous duty, CR-151-154 incl. (Type RA.) Printing press control, CR-171 and 171-A (Type PB). Field rheostats, CR-174 (Type F). Field rheostats, sprocket driven, CR-178 (Type F). Field rheostats, electrically operated, CR-179 (Type F). Also CR-111, CR-163 and CR-155 to 158 incl. (Types SO, RO and SFO respectively), with overload release devices which are inoperative during process of starting motor. Approved only when other circuit breakers or fuses are installed in connection with them. See N. E. Code Rule 60-g. Approved Jan. 3, 1910. Manufactured by

Fort Wayne Electric Works, Fort Wayne, Ind. (G. E. Co., Mfrs.)

All capacities 125-500 V. Motor starters, CR-107 and CR-109 (Type SA). Motor starters with field control, CR-162 (Type SFA). Speed regulating, continuous duty, CR-151-154 incl. (Type RA). Printing press control, CR-171 and 171-A (Type PB). Field rheostats, CR-174 (Type F). Field rheostats, sprocket driven, CR-178 (Type F). Field rheostats, electrically operated, CR-179 (Type F). Also CR-111, CR-163 and CR-155 to 158 incl. (Types SO, RO and SFO respectively), with overload release devices which are inoperative during process of starting motor. Approved only when other circuit breakers or fuses are installed in connection with them. See N. E. Code Rule 60-g. Approved Jan. 3, 1910. Manufactured by

Sprague Electric Company, New York, N. Y. (G. E. Co., Mfrs.)

TRANSFORMERS.

Reppell Bell Ringing Transformer for use on 100-125 volt A. C. circuits. Open circuit voltage on secondary 7 volts. Approved only for ringing bells, or for similar signaling work and when primary is installed in accordance with Class C of the National Electrical Code; Jan. 3, 1910. Manufactured by

Reppell Electric Co., 7 West 31st St., Kansas City, Mo.

NEWS OF THE STATIONARY ENGINEERS

PREAMBLE.—This Association shall at no time be used for the furtherance of strikes, or for the purpose of interfering in any way between its members and their employers in regard to wages; recognizing the identity of interests between employer and employe, and not countenancing any project or enterprise that will interfere with perfect harmony between them.

Neither shall it be used for political or religious purposes. Its meetings shall be devoted to the business of the Association, and at all times preference shall be given to the education of engineers, and to securing the enactment of engineers' license laws in order to prevent the destruction of life and property in the generation and transmission of steam as a motive power.

California.

No. 1. San Francisco, Thursday, 172 Golden Gate Ave. Pres., P. L. Ennor. Sec., Herman Noethig, 816 York St.

No. 2. Los Angeles. Friday, Eagles' Hall, 116½ E. Third St. Pres., J. F. Connell. Cor. Sec., W. T. W., Curl, 4103 Dalton Ave.

No. 3. San Francisco. Wednesday, Merchants' Exchange Bldg. Sec., David Thomas, 914 O'Farrell St.

No. 5. Santa Barbara. Geo. W. Stevens, 2417 Fletcher Ave., R. R. No. 2.

No. 6. San Jose, Wednesday. Pres., W. A. Wilson, Sec., Lea Davis, 350 N. 9th St.

No. 7. Fresno. Pres., A. G. Rose. Sec., E. F. Fitzgerald, Box 651.

No. 8. Stockton. Thursday, Masonic Hall. Sec., S. Bunch, 626 E. Channel St. Pres., H. Eberhard.

Oregon.

No. 1. Portland. Wednesday, J. D. Asher, Portland Hotel. Pres., B. W. Slocum.

No. 2. Salem. A. L. Brown, Box 166.

Washington.

No. 2. Tacoma. Friday, 913½ Tacoma Ave. Pres., Geo. E. Bowman. Sec., Thos. L. Keeley, 3727 Ferdinand St., N., Whitworth Sta.

No. 4. Spokane. Tuesday. Pres., Frank Teed. Sec., J. Thos. Greeley, 0601½ Cincinnati St.

No. 6. Seattle. Saturday, 1420 2d Ave. Pres., H. R. Leigh. Sec., J. C. Miller, 1600 Yesler Way.

Practical letters from engineers and news items of general interest are always welcome. Write your items regardless of style. Communications should be addressed to the Steam Engineering Editor.

SAN FRANCISCO NO. 1.

San Francisco No. 1, N. A. S. E., held a very interesting meeting on Thursday evening, January 13th. A committee of five was appointed to confer with a like committee of California No. 3, N. A. S. E., to arrange for a ball to be given this winter. The purpose of this ball is to enable the families of the members of the N. A. S. E. to become acquainted and also to bring before the public the fact that such an organization exists. After the close of the business session, an open meeting was called to order by President P. L. Ennor, who introduced Mr. F. R. Graff as the lecturer of the evening. The lecture consisted of the following subjects: The Shattuck flash boiler, rotary steam engine, "steel coat" process, and rotary gas and gasoline engine. The above subjects were listened to with much interest, and many questions were asked which proved very instructive.

CALIFORNIA NO. 2.

The new year has started with signs of a big increase in membership, we having about ten applications on file and more in sight. We had a total gain of 54 for 1909, but with the suspensions made at the last of the year it leaves us with 434 active members. Our educational committee headed by Bro. Geo. A. Reichard, keeps things on the move every meeting night and he always has something for the future in the way of a lecture to bring the members out. The Seventh Annual Convention committee is very busy at present getting ready for the meeting to be held here and if all their plans are carried out, it will be a time to be remembered by all attending.

N. A. S. E. CONVENTION.

The Seventh Annual Convention of the California State Association, National Association of Stationary Engineers, will be held in Los Angeles some time in the early summer, 1910, under the auspices of Los Angeles Association No. 2, composed of 450 of the best engineers of the city and we wish to place before the public and the visiting delegates from all parts of the State, an exhibit along mechanical and engineering lines, that has never been equaled.

We have the written indorsement of the Merchants and Manufacturers' Association and the Los Angeles Chamber of Commerce and the assurance from them that they will do all in their power to make our exhibit a success. We are confident that we can accomplish our aim, if we can have the support of the manufacturers and dealers in engineering and allied lines.

The convention was held this year in the city of San Francisco and to say the least it was the most successful one ever held by a State Association throughout the United States, by reason of the magnificent exhibit placed before the public by the manufacturers and dealers in machinery and engineers' supplies, under the auspices of the members of the two associations of that city and what San Francisco can do, so can Los Angeles.

We will continue the exhibit for one week, during which time the convention will be in session alternate days, thus giving the delegates and visitors and people of our city an opportunity of seeing what we produce and have in engineering and manufacturing lines.

FRED. J. FISHER,
Chairman Convention Committee.
W. T. W. CURL, Secretary.

PRACTICAL MECHANICS—PAPER NO. 4.

In order to intelligently understand the applications of the instantaneous center a complete case will be worked out. For this example, consider the mechanism shown in Fig. III.

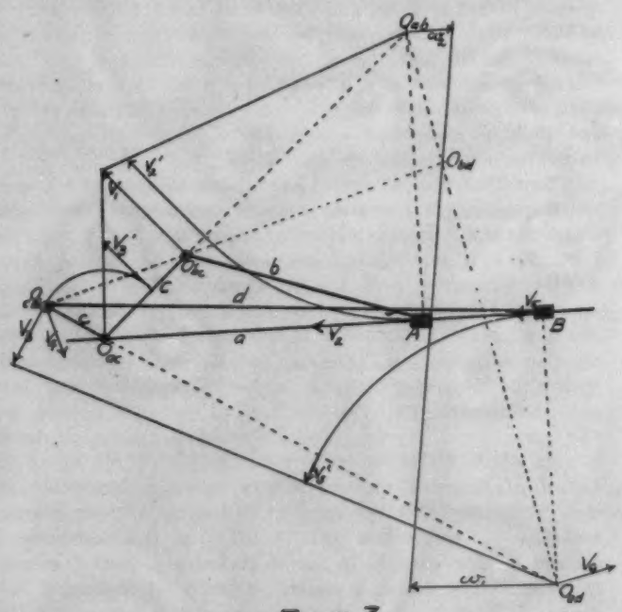


Figure 3

The train of parts in the diagram represent the crank, connecting rod, and eccentric rod gear of a simple slide valve engine. In referring to the various parts of this mechanism, and hereafter generally, we shall adopt the nomenclature used by Prof. J. N. Le Conte in his "Mechanics of Machinery." The two subscripts at each center indicate that the point so designated is the center for the two parts similarly lettered. Thus: O_{ae} is the center about which c is turning relatively to a or a relatively to c.

With a given number of parts a definite number of centers, either permanent or instantaneous, may always be found to exist. In Fig. III we are considering four independent parts, *a*, *b*, *c* and *d*, *a* being the engine frame, *b* the connecting rod, *c* the crank (and also the eccentric since there is no relative motion between these two parts), and *d* the eccentric rod. *A* denotes the center of the crosshead pin and *B* the center of the pin connecting the eccentric rod with the slide valve rod. For convenience we are considering the line of motion of *A* and *B* in the horizontal plane of the engine shaft, the center of which is O_{ac}.

The possible centers are obviously, O_{ab}, O_{ac}, O_{cd}, O_{bc}, O_{bd} and O_{ad}. Of these six centers, we can, by direct inspection, locate the permanent ones as follows: O_{ac}, O_{bc} and O_{cd}. Keeping in mind the law that the three centers for any three adjacent parts must all lie in the same straight line, we may proceed to determine the three remaining centers.

Proceeding as in Paper II, the center O_{ab} is found by erecting perpendiculars to the directions of motion of two known points of *b*. These two points are obviously the points of attachment of *b* to *c* and to *a*. The directions of motion of these two points with reference to *a* are shown by the arrows V_1 and V_2. The perpendiculars to these two directions intersect in the point O_{ab}, which is therefore the instantaneous center about which *b* is for the instant turning relatively to *a*.

Consider next the center O_{ad}. The two points of *d* whose motions with reference to *a* are known are O_{cd} and *B*. O_{ad} is turning in the direction shown by V_b, while *B* is moving in the direction V_2. Perpendiculars to these two directions intersect as seen at O_{ad}, the instantaneous center for *a* and *d*. We have now to determine O_{bd}.

We know that the center O_{cd}, which is a known point of *d*, is turning about *b* in a direction V_4 perpendicular to the line drawn through O_{cd}, O_{bc}, hence the required center will lie somewhere on this line. We know that at the instant under consideration center O_{ad} as a point of *a* is moving about O_{ab} in the direction V_6 perpendicular to the line joining O_{ab} and O_{ad}. But at this instant O_{ad} is also a point of *d* which is moving in common with *a*, since it is the center for these two parts. Therefore, the center O_{bd} must lie on the line O_{ab} O_{ad}, and hence at its intersection with the line O_{cd} O_{bc} as shown.

By applying the "three in a line" rule this center could have been found by inference; thus, *b*, *c* and *d* being adjacent parts, their respective centers must fall in the same line. Two of these centers O_{ad} and O_{bc} being already known, their line is established. Likewise *a*, *b* and *d* are adjacent parts, two of whose centers O_{ab} and O_{ad} are known. Hence the line joining them must pass through the third center. The point of intersection of those two lines is necessarily the only one that will satisfy all conditions.

By combining these two methods of analysis the complete determination of all the centers for any number of interconnected parts is possible.

We believe that if the foregoing solution has been carefully followed, the reader will have little difficulty in carrying out the analysis of such special cases as he may desire to investigate.

Determination of Relative Linear Velocity.

One of the most useful applications of the instantaneous center in machine design is in determining the velocity of any point when that of any other point in the train of parts is known. Suppose, for example, that we know the velocity, at any instant, of the crosshead of a simple engine and that we desire to find the velocity of the slide valve for the same instant. In Fig. III this may be stated thus: Knowing the velocity of *A*, find that of *B*. Let V_3 represent in direction and amount the known velocity of the crosshead *A*. Project this velocity on a circular arc to the line of *c* and call this V_3'. Through O_{ab} and the end of V_3' draw a line to cut the line *V*. This intersection will give the value of V_1, the linear velocity of O_{bc}, the crank pin. This deduction is based upon the fact that with a common angular velocity the circumferential, i. e., linear-velocities of two points in a rotating body are in the ratio of their respective radii. In the case in point all parts of *b* are for the instant in rotation about center O_{ab}; hence the velocity of O_{bc} is to velocity of *A* as their respective distances from O_{ab}. The construction taken is a simple geometric method of obtaining this ratio.. It depends upon the law that in similar triangles the bases bear the same ratio as the altitudes.

To proceed with the analysis, project the eccentric radius O_{cd} O_{ac} on a circular arc till it cuts the line connecting V_1 with O_{ac}, the shaft center. At this intersection draw V_3' parallel to V_1, and then lay off V_3 equal to V_1. V_3 is easily seen to be the circumferential velocity of the center of the eccentric. This value of V_3 is also the velocity of O_{cd} considered as a point of *d* turning about O_{ad}. Now, connect the end of V_3 with O_{ad}, project the radius O_{ad} *B* on to this line and draw V_5' parallel to V_5. Lay off V_5 at *B* equal to V_5' and by the same reasoning as before you have the required linear velocity of *B*.

This simple form of analysis with the use of similar triangles and the instantaneous centers is capable of many valuable applications to machine relations.

Determination of Relative Angular Velocity.

Relative angular velocities can be similarly determined by the use of the instantaneous center. Referring again to Fig. III we have given the angular velocity ω_1 of *b* about its center O_{ab} and are required to find ω_2, the angular velocity of *d* about its center O_{ad}. Lay off ω_1 from O_{ab} and draw through O_{bd}, the common center of the parts involved, a line till it cuts ω_2 drawn through O_{ad}. ω_2 as thus intersected will be the required value of the angular velocity of *d* about *a*. This may be proven by considering the center O_{bd}. As a point of *b* its angular velocity is ω_1, multiplied by its distance from O_{ab}. As a point of *d* its angular velocity is ω_2 multiplied by its distance from its center O_{ad}; but since O_{bd} is common to both *b* and *d* the ratio of $\frac{\omega_1}{\omega_2}$ must be as the ratio $\frac{O_{ad}\ O_{bd}}{O_{ab}\ O_{bd}}$

The construction above taken is seen to again involve two similar triangles, the bases of which are the two angular velocities. These are, by the law of triangles above stated, directly proportional to the adjacent sides, which sides are the distances respectively of the two centers from the common center. Prof. Le Conte sums this analysis up as follows:

"The relative instantaneous center of two moving bodies divides the distance between their centers in the inverse ratio of their angular velocities referred to a fixed body."

In practical machine design we rarely have to do with angular velocities about any other than the permanent centers. The analysis herein given is often useful; however, and should be thoroughly mastered.

TRADE NOTES.

B. Trenkman & Co., of Portland, have just completed a 13,000 gallon oil tank for the Multnomah Mohair Company's power plant at Sellwood.

R. B. Swayne, who has been in the pole and piling business in San Francisco for two years, has established a pole and piling yard in Oakland, where he will aim to carry a complete stock of the principal sizes in general use and of the best quality of Washington timber.

Smith, Emery & Co., inspecting and testing engineers, announce the following extensions in their iron and steel inspection department: Chief inspector, San Francisco office, W. F. Richards of Philadelphia; Los Angeles office, E. O. Slater and E. G. Harpham of San Francisco; Pueblo, Colo., office, M. L. Kulp of St. Louis; and Birmingham, Ala., office, R. T. Miller of San Francisco.

NEWS NOTES

FINANCIAL.

PLEASANTON, CAL.—An ordinance calling for an election February 8th authorizing $5000 worth of waterworks improvement bonds and $35,000 worth of sewer bonds was read for the first time.

SAN FRANCISCO, CAL.—The Hetch-Hetchy water bonds were carried by a vote of 32,876 to 1607. The Spring Valley bonds were lost by a vote of 22,059 to 11,724, or 1234 less than the necessary two-thirds majority.

POMEROY, WASH.—Mayor Howell has advised the Council to make arrangements for the issuance of city bonds for $16,500, for replacing the present wooden pipe leading from Butler Springs to Pomeroy with steel pipe.

DRAIN, ORE.—A special election will be held at the city hall January 22, 1910, to vote upon the issuance of $20,000 in bonds bearing a maximum interest of 5½ per cent, to run 30 years, $15,000 for a water system, and $5000 for sewers for this city.

BRAWLEY, CAL.—The City Trustees will receive sealed bids up to February 5th for $44,000 bonds voted December 28, 1909, for water works, etc. These bonds will be dated January 1, 1910 and bear 5½ per cent interest, payable semi-annually, and will mature in 20 years with privilege of prior payment.

MONTEREY, MEX.—Stockholders of the Guanajuato Power & Electric Company met in Colorado Springs, Colo., and voted to increase the capital from $3,500,000 to $5,000,000. The company is controlled by Henry Hine and L. E. Curtis, both of Colorado Springs. The company's extensive system at Guanajuato will be enlarged.

COTTAGE GROVE, ORE.—No bids have been received for the $100,000 5 per cent 25-year water bonds of the city, the trouble being that in the preparation of the ordinance calling for bids no provision was made for a sinking fund for the payment of principal and interest, other than by the levy of a tax in case the revenue from the system proved insufficient.

LOS ANGELES, CAL.—The William R. Staats Company is handling the Mt. Whitney Power & Electric Co., first mortgage six per cent gold bonds, dated October 1, 1909, due 1939. The Mount Whitney Power & Electric Company, owns and operates electric properties having a combined capacity from water power and steam plants of approximately 8,000 horsepower and serves with electricity for light and power, principally the latter, an extensive territory in the San Joaquin valley, including Tulare county, part of Kern county, and the cities and towns of Visalia, Tulare, Porterville and Lindsay. The net earnings as of October 31, 1909, were shown to be $172,322.38, or more than three and a half times the interest charge. The bonds now being offered, amounting to $350,000, are secured by a first lien on all property, rights, franchises and contracts.

LOS ANGELES, CAL.—The Pacific Light & Power Company has been reincorporated at $40,000,000, in order to make considerable enlargements and be prepared to meet the demands that will be made upon it. The incorporators are: H. E. Huntington, Howard E. Huntington, W. G. Kerckhoff, Caspar Cohn, George S. Patton and W. A. Kemp. No stock will be placed on the market, as the company has been fully financed, though bonds may be issued later. The Redondo plant is to be enlarged at once. It is proposed to spend $1,500,000 in adding three more units, making six units of 7,500 horsepower each. The sum already invested in the Redondo plant amounts to $1,750,000. More water power will be developed at Kern River. The company will run new lines, and build new plants in the mountains. It will also probably build new plants in the neighborhood of the city. The car lines are extending so rapidly, that the Pacific Light & Power Company, which furnishes the power, finds it necessary to prepare for the needs of the future. The Pacific Light & Power Company owns all the stock of the Ontario & San Antonio Heights Railway, the San Bernardino Gas & Electric Co., the Mentone Power Co., and the Riverside Power Co. It was incorporated March 6, 1902 and absorbed the San Gabriel Electric Co. The capital stock is owned by the Los Angeles Railway, and supplies power to the Los Angeles Railway, the Pacific Electric Railway, the Los Angeles Interurban, the Los Angeles & Redondo Railway Co., and does a general lighting and power business in Los Angeles and vicinity.

INCORPORATIONS.

WOODLAND, WASH.—Woodland Water & Power Company; $50,000; S. A. Burns et al.

TOPPENISH, WASH.—Submerged Power Wheel Company, $50,000; W. B. Campbell, et al.

ELBERTON, WASH.—Elberton Milling & Power Company; $60,000; Charles Hichliff, et al.

SANTA FE, N. M.—Rio Lucero Power Co. of Santa Fe, $100,000, by M. Martinez, B. G. Phillips and P. N. Black.

SEATTLE, WASH.—Granite Lighting & Power Company, of Seattle; $500,000; Harry M. Frost, James T. Hamilton, Cornelius Christopher, James H. Fox and Timothy J. O'Neil.

WHITE SALMON, WASH.—The Columbia River & Mount Adams Railroad Company has been incorporated with capital stock of $20,000,000, to build an electric railway from some point on the Columbia river in Klickitat county, northerly through parts of Klickitat, Yakima and Skamania counties, to a point in the vicinity of Mount Adams. The trustees are Adolph A. Suksdorf, E. H. Suksdorf, and Oswald N. Suksdorf, all of Spokane.

FRESNO, CAL.—The Fresno City, Belmont and Yosemite Railroad Company went out of existence last week, at a meeting of the stockholders held in the offices of A. G. Wishon. The company when originally formed secured the old franchise for a street railroad out on J street, Tuolumne and Blackstone to Belmont and out Belmont to Fresno avenue. This franchise was bought up by Griffith and McKenzie when they took up the traction work here.

TRANSMISSION.

NORTH YAKIMA, WASH.—E. F. Benson, head of the Prosser Power Company, announces that his company will proceed at once with the erection of its proposed 600 horsepower electric generating plant two miles below the city.

SAN BERNARDINO, CAL.—The Arrowhead Reservoir & Power Company, Victor Smith, general manager, San Bernardino, has purchased the Los Flores ranch on the Mojave River. The ranch comprises about 5000 acres, with valuable water rights.

OAKLAND, CAL.—At the last meeting of the Board of Supervisors the People's Electric Light & Power Company filed a revised application for a franshise for electric transmission lines through the county of Alameda, and for the conducting of electricity for furnishing heat and power. The changes in the previous application were made necessary by the annexation election.

CHIHUAHUA, MEX.—The Mexican Northern Power Company of Canada has been granted a concession to build two big dams on Conchas River, one of which will be at Boquilla, located about seventeen miles above Santa Rosalia and others at La Joya, farther up the Conchas. The Boquillo dam will impound enough water to develop 30,000 horsepower.

SAN JOSE, CAL.—The Sierra Light & Power Company has begun suit in the Superior Court of this county against the Spring Valley Water Company, to obtain a right of way for a transmission line in the vicinity of Dumbarton Point. The Suburban Company, the City and County of San Francisco and the Union Trust Company are also named as defendants in the suit. The Sierra Power Company has secured rights of way for 50-foot steel poles at a distance of 800 feet apart through Tuolumne, Calaveras, Stanislaus, San Joaquin, Alameda, Santa Clara, San Mateo and San Francisco counties. The only portion not yet secured by the corporation is a small strip of land near Dumbarton Point owned by the Spring Valley Water Company and subsidiary concerns.

SACRAMENTO, CAL.—Thirty thousand acres of land along the Stanislaus, Mokelumne and Yuba Rivers have been withdrawn from all forms of entry by the United States Department of the Interior. Information to that effect has been received by John C. Ing, Receiver of the United States Land Office in this city. The orders follow closely on a similar one affecting land along the North Fork of the Feather River, issued on December 19. The action, it is stated in the orders received by Receiver Ing, is temporary and will be in force pending legislation affecting the disposal of waterpower sites. The withdrawal along the Stanislaus River affects 4924 acres, of which 710 are entered. The land follows the meanderings of the Stanislaus River in fractional parts of the following townships: Township 3 north, range 14 east; township 2 north, range 14 east; township 2 north, range 13 east; township 1 north, range 13 east. Along the Mokelumne River 11,112 acres are withdrawn, of which 1400 are entered. The land lies along the Mokelumne River in fractional parts of various townships.

ILLUMINATION.

DRAIN, ORE.—An ordinance granting to the Drain Light & Power Company a franchise to light the city with electricity has been introduced in the Council.

ALAMEDA, CAL.—A contract has been signed with the Westinghouse Electric & Manufacturing Company to furnish the city of Alameda with transformers for the coming year.

GLENDALE, CAL.—Sealed bids are being received by the Trustees for furnishing the city f. o. b. cars, 5000 pounds No. 4 medium hard drawn triple braid weatherproof copper wire.

THE DALLES, ORE.—At its next monthly meeting the City Council will be asked to grant a franchise to J. D. Wilcox of Portland, who represents capitalists who desire to erect a gas plant in this city.

TACOMA, WASH.—The County Commissioners granted a franchise to the Tacoma Gas Company to construct a gas pipe line across and along certain roads from the city of Tacoma to the city of Puyallup.

CHEHALIS, WASH.—The Seymour Brewer Gas Company which will supply this city and Centralia with gas has secured a site in the north end of town 100x450 and will begin construction at an early date.

PORTLAND, ORE.—The Pacific Coast Engineering Company has been awarded the contract for putting in the foundation for a large power plant which will be erected on the river front at the foot of East Lincoln street by the Portland Railway, Light & Power Company. It will be necessary to drive 4000 piling for the foundation. A frame bulkhead will also be built to protect the piling.

SPOKANE, WASH.—The Board of Public Works is receiving sealed bids for three transformers with protection devices with all connections, in accordance with plans and specifications on file with the Board of Public Works.

RIVERSIDE, CAL.—The Board of Supervisors opened bids for a gas and electric light franchise for the town of Beaumont and the Beaumont Gas & Power Company were the only bidders. They bid $25 for the franchise and secured it.

LONG BEACH, CAL.—At the annual meeting of the Inner Harbor Gas Company it was decided to move the present plant on Alamitos avenue to the flat west of the city. The directors of the company are: D. M. Dobbins of Pasadena, F. W. Stearns, Thaddeus Lowe, etc.

TACOMA, WASH.—Sealed proposals are being received at the office of the Commissioner of Public Works for 1000 horsepower of electric current, on the peak load, for a period of eight months, commencing February 1, 1910, to be delivered at Station "C," South Tacoma.

SAN BERNARDINO, CAL.—San Bernardino and Colton are to be connected with a 3-inch high pressure gas main which will be used to convey gas from this city to Colton, three miles away. Later, when the central plant is built at Colton, the long main will be part of the distributing system from that source.

SEBASTOPOL, CAL.—John E. Bennett of San Francisco, president of the Russian River Light & Power Company, states that his company has awarded the contract for the construction of a high power electric line from Sebastopol extending north to the Russian River and thence down to Duncan's Mills, and from there south to Occidental.

VENICE, CAL.—General Manager W. A. Brackenridge, Assistant General Manager R. H. Ballard, and Electrical Engineer J. A. Lighthipe of the Southern California Edison Company, visited Venice and Playa del Rey recently to look at sites which have been offered by Abbott Kinney for the $5,000,000 steam generating plant, which the company contemplates erecting on the beach near Los Angeles.

STOCKTON, CAL.—The sinking of gas well No. 8 on El Dorado, near Channel street, will be commenced by the Stockton Gas & Electric Corporation at once and the work kept up until a heavy flow of gas is secured. It is now down 1789 feet and gas in small quantities has been encountered, but the company intends going much deeper unless a large quantity of gas is encountered. Well No. 9, in the northeastern part of the city, has been completed at a depth of 2630 feet with a 12-inch casing and a large quantity of gas is steadily flowing. The object in having the wells located in different sections of the city is to supply gas for cooking and heating and in those particular localities without it having to go through long mains. The new well has greatly increased the supply.

TRANSPORTATION.

MEDFORD, ORE.—The City Council has granted to John R. Allen a franchise to operate an electric road in this city.

LOS ANGELES, CAL.—The Los Angeles Pacific Railway will spend $6,000,000 in the construction of a subway and other improvements.

PORTLAND, ORE.—President Josselyn has started construction on three miles of the Cazadero division of the Oregon Water Power Company's line.

LOS ANGELES, CAL.—At a meeting of the directors of the Los Angeles-Pacific Railroad last week it was voted to issue bonds to the amount of $20,000,000, $10,000,000 of which will be used for improvements of roads and the other in paying old debts.

DAVENPORT, WASH.—The county commissioners have granted a franchise to the Washington Water Power Company for a spur line from Harrington to Odessa.

LOS ANGELES, CAL.—A bid of $100 by Robert Marsh and John Howes for a franchise for a street railroad on West Thirty-ninth street and Vermont avenue was not accepted by the Council.

VANCOUVER, B. C.—The B. C. Electric Railway is making preparations to construct at least 10 miles of railway in South Vancouver and Point Grey municipalities within the next five years.

SAN FRANCISCO, CAL.—The old Board of Supervisors voted not to grant the franchise of the "crosstown-Devisadero street" car line, applied for by G. R. Willcutt, acting for the United Railroads.

COLFAX, WASH.—A. M. Lupfer of the Inland Empire electric line is in the city looking after extending the road from this place toward Asotin and also announces that a line may be surveyed to Walla Walla.

ALAMEDA, CAL.—The Oakland Traction Company decided to improve its existing lines here for a party of surveyors were at work yesterday laying out lines for the broad gauging of the High street track.

FRESNO, CAL.—The ordinance providing for franchises on the west side for the Fresno Traction Company has been rejected by the Board of Trustees, and a resolution of intention to grant certain franchises passed to print.

THE DALLES, ORE.—Bids will be received until February 1st at the office of Newell, Gossett & Walsh, 32 Washington building, Portland, this city for the grading, tracklaying and bridging on the Portage railway from Eddy to The Dalles.

SEATTLE, WASH.—The City Council has passed an ordinance, granting to the Seattle Electric Company, a franchise to construct a street railway upon certain parts of Atlantic street and Utah street, and other streets, avenues and places in Seattle.

MONTESANO, WASH.—The Board of County Commissioners has been enjoined from granting a franchise to the Grays Harbor Interurban Company, applied for and granted at the December meeting for building electric lines on various roads of the county.

EUGENE, ORE.—The P. E. & F. Railway Company has agreed to build for a bonus of $35,000, several extensions to the city street railway system, including a loop of five miles in length out South Willamette street, past College Hill, then into the city again by way of Oregon avenue, and at the intersection of Eleventh and Willamette streets.

OAKLAND, CAL.—On account of the objection of W. R. Scott, assistant general manager of the Western division of the Southern Pacific Company, to the request of the railroad committee of the City Council that the company furnish and maintain street lights along the proposed right of way of the Peninsular Street Railway Company, the matter of finally recommending the granting of the franchise has been laid over until the next meeting of the committee.

CANBY, ORE.—The construction of an electric railway from Canby to Molalla is proposed and it is said that 20 miles of the line will be in operation by July 1st. Later the line will be extended to Portland, crossing the river at Canby, and going by way of the west side. Already an option has been placed on the steel to cover 16 miles, engine and 60 cars, formerly used on a logging railroad. This line, in no way, will interfere with the proposed Swift Railroad, as it will pass through a different section of the county, and through some of the finest timber land. The electricity for the proposed railroad will be supplied by the Canby Canal Company.

BAKER CITY, ORE.—The franchise to build a street railway system in Baker City, granted to Anthony Mohr, A. K. Bentle and T. B. Neuhasen last summer, and which expires this month, has been renewed and six months' time given for the franchise owners to begin work. The contract for the ties for the 45 miles of road to be built has been let according to Anthony Mohr, promoter of the proposed line. Orders for heavy gasoline cars will be placed for delivery in April or May, by which time it is hoped to have lines ready for operation.

WATERWORKS.

DIXON, CAL.—Bids will be received up to March 1st for a franchise to erect waterworks here.

MONROVIA, CAL.—The City Trustees will ask for bids at the next Council meeting for cast iron pipe to be laid in various streets.

PORTLAND, ORE.—The water board has awarded to the Montague O'Reilly Company a contract to lay a main to Twelfth street, between Marshall and Pettygrove streets for $2300.

FARMINGTON, N. M.—The town board has by unanimous vote decided to call an election to vote on a $25,000 bond issue to construct a municipal water system to supply the town with water from San Juan river.

TACOMA, WASH.—The City Council has passed an ordinance proposing to the voters that the city of Tacoma construct, as an addition to its existing water system a gravity water system from Green river in King county, Washington.

OAKLAND, CAL.—The Board of Public Works has accepted the pipe system of the recently completed salt-water fire-fighting plant from the contractors, Cotton Bros. The pumping plant, situated at "The Willows," on the shores of Lake Merritt, was subjected to a ten-hour official test, which proved satisfactory.

SANTA BARBARA, CAL.—The City Clerk will receive sealed bids up to February 17th for a pipe line franchise from the Potter hotel railroad spur track on city block 271, along Montecito street, to Castillo street, and along Castillo to the east corner of city block 309½. The Santa Barbara Gas & Electric Company has applied for such a franchise.

TACOMA, WASH.—The City Council has passed an ordinance calling for the laying of twelve-inch, ten-inch and eight-inch water mains, together with the necessary hydrants and connections with the present water main in Local Improvement District No. 549, and providing for the issuance of local improvement bonds to cover the cost.

REDONDO, CAL.—The Board of Trustees will receive sealed bids up to January 24th for furnishing and installing an auxiliary pumping plant consisting of a centrifugal or turbine series horizontal pump with a working pressure equal to 200 feet, including suction and friction and to have a capacity of 520 g. p. m. when working against head above specified; a 3-phase induction motor to operate on 2080 volts and to form a direct connected unit; and a marble switchboard.

COLUSA, CAL.—At an adjourned meeting of the Trustees last week the Board, after the consideration of some fifteen combination bids, as well as bids on the plant as a whole, let the contract for the new waterworks and distributing system, the contract price for the same being $47,935. The successful bidders were: Standard Engineering Company of San Francisco, represented by C. F. Braun, for the distributing system, wells, etc., for $31,857.10; and F. C. Roberts Co., of San Francisco for pumping station, tank and tower for $16,078.

FEB